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Electrical News
Generation, Transmission and Application of Electricity

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Vol. 26 Toronto, January 1, 1917 No. 1

Engineers at Home and War Work

Of the members of the engineering profession in Canada who have not entirely given over their time to further the carrying on of our war, there are few, if any, who have not expressed an ardent desire to be given an opportunity to devote such hours daily as they may be able to take off from their regular duties, to some form of war work. In many cases the time that could be so utilized may run into four or five hours a day, or even more. Repeatedly, for instance, one hears the engineer express his willingness to leave the routine side of his own private business over for the evenings, so as to leave him available during the greater part of the day. Various authorities, both civil and military, have been approached by one and another of the engineering profession to see if their partial time services could not be employed in some way, as these men naturally feel that with their technical experience they could do much to assist in organization work, in training unskilled labor, or in some other way.

Unfortunately all such suggestions have met with an unproductive reception, chiefly, there is little doubt, because it implies a complication of the machinery of government, and this machinery, our governing bodies have been either too conservative, too busy, or too sceptical to change. Undoubtedly all our government departments are over their heads with work, but they have taken sufficient cognizance of the situation outlined above, to intimate that our engineers get together and themselves formulate a plan which in turn will receive careful government consideration.

Whether or not the idea is feasible remains to be seen, but the matter is going to be discussed and studied from all sides, and to that end, Mr. Wills Maclachlan, secretary of the Toronto Branch of the A.I.E.E., has kindly undertaken to send out a number of letters to a limited number of sister engineering societies as well as to a limited number of individual engineers, calling a meeting for Thursday, December 28. Every engineer within reach of Toronto is urged to be present and lend his experience and his voice to this great cause. Out-of-town engineers who cannot be in Toronto on that date can be of splendid assistance if they will forward any suggestions by mail to Mr. Maclachlan either before the first meeting or at any later date.

It is surely an anomalous conclusion, which cannot be accepted as final, that simply because many of us cannot, for different reasons, give up our entire time, that therefore one-half or one-third of that time is not worth consideration. Surely we can be useful at least in proportion to the time we can give, if, first, we can only succeed in working out a plan of organization to fit into these new conditions. We believe it is the duty of every engineer in Canada to give this matter his very careful and immediate thought. We are constantly told that it is an engineers' war, and, if so, there is undoubtedly war work for engineers to do at home as well as abroad. Most of us are painfully aware that we are doing all too little to further this righteous cause, but the question always confronts us as to how we could do any more. After all, however, is the whole question not an engineering one? Is it not up to the engineer to supply the answer to his own question? We have no doubt that the matter of utilizing the partial time of the engineering profession in Canada is a feasible proposition and can be solved by the engineering profession itself if sufficient thought is given to it. A copy of the letter referred to above follows:

"The war has been many times called an 'Engineer's War.' Up to the present engineers have certainly put their shoulders to the wheel, but a great number feel that they wish to do more and can do more. There are a number of engineers in Toronto who have offered their services for part of their time, but no plan has been evolved as yet so that their services could be used.

"Would it not be well for the executives of the engineering and technical societies of Toronto to meet and discuss this matter and lay the groundwork of an organization of the engineers so that they can be used where their technical training will be of most value to the country?

"A meeting is therefore called for Thursday, December 28th, at 8 p.m., in the lecture room of the Engineers Club, to hear what has been done and to discuss ways and means for carrying on these matters."

Russians Calling for Hydro-electric Machinery

The Canadian Government Commercial Agent at Petrograd, Russia, has advised the Superintendent of the Dominion Water Power Branch that the new Imperial Water Ways Department of the Russian Government has now under review a number of very important water power projects in various parts of Russia, and has suggested that it is not unlikely that the Chief Engineer of the Imperial Water Ways Department would wish to avail himself of Canadian engineering experience in the design and construction of hydro-electric developments, and also of the manufacturers of all kinds of equipment, electrical, hydro-electric and mechanical, required for a complete water power development.

The Dominion Water Power Branch is undertaking to inform the Canadian Government Commercial Agent at Petrograd of the names of all Canadian industries which turn out equipment employed in water power development, also of the names of Canadian contractors who have constructed hydro-electric undertakings throughout the Dominion.

The Secretary of the Canadian Society of Civil Engi-

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neers, Montreal, is arranging to furnish as complete a list as possible of Canadian engineers who have designed and constructed power plants.

The Superintendent of the Water Power Branch is endeavoring to collate the necessary data to be forwarded to Petrograd with the least possible delay and, while it is possible that direct communications may be made to the better known Canadian contractors and Canadian manufacturers of power equipment, it would be advisable for readers of the "Electrical News" to communicate direct with this official at Ottawa.

The Dominion Water Power Branch deserves credit for its foresight in making known, by every possible means at its command, the great work accomplished by Canadian engineers and contractors in power development on this continent. Russia should prove a tremendous field for Canadian engineers and business men in power development activities, and every possible effort should be made to take advantage of the present situation.

Some months ago at the initative of this Branch, several prominent Russian engineers made a visit to Canada to see for themselves what Canadian engineers and business men have already accomplished in power development. One of the engineers returned to Russia immediately, and it is probable that the urgent request made to the Superintendent of the Dominion Water Power Branch for information, as set out above, is a direct result of this visit.

Chippewa Development By-Law

The Hydro-Electric Power Commission of Ontario, acting in accord with the Ontario Government, are causing to be submitted to the electors of a large number of municipalities in Southwestern Ontario on January 1 a by-law expressing approval of the Ontario Power Commission's proceeding with the development of hydro-electric power on the Chippewa River. It was the original intention of the Ontario Government to handle this matter as a government proposition, but it has now been determined that the decision shall rest with the municipalities themselves, who are now asked to pass upon it in a general way. Actual figures are not being submitted at this date, but should the general sentiment prove favorable to the project, figures will be compiled and a second by-law, authorizing the amount for which each municipality will be held responsible, will be submitted at the later date. The present by-law simply reads as follows:

"Are you in favor of having the municipality develop or acquire, through the Hydro-Electric Power Commission of Ontario, whatever works may be required for the supply of electric energy or power, in addition to such electric power as is already obtained under the existing contract with the Hydro-Electric Power Commission of Ontario?"

Practically every municipality at present taking power from the commission will submit this by-law at the New Year or very shortly after. The list reads as follows:

Municipalities—Niagara District.

Acton, Ailsa Craig, Ayr.

Baden, Beachville, Blenheim, Bolton, Bothwell, Brampton, Brantford, Burford, Burgessville, Breslau.

Caledonia, Chatham, Clinton, Comber.

Dashwood, Delaware, Dorchester, Dresden, Drumbo, Dundas, Dublin, Dunnville, Dutton.

Elmira, Elora, Embro, Exeter.

Fergus, Forest.

Galt, Georgetown, Goderich, Guelph, Granton.

Hagersville, Hamilton, Harriston, Hensall, Hespeler, Highgate.

Ingersoll.

Kitchener.

Lambeth, Listowel, London, Lynden, Lucan.

Milton, Milverton, Mimico, Mitchell, Mount Brydges.

New Hamburg, New Toronto, Norwich, agara Falls. Otterville.

Palmerston, Paris, Petrolia, Plattsvill Point Edward, Port Dalhousie, Port Credit, Port Stanley, ton, Princeton.

Ridgetown, Rockwood, Rodney.

Sarnia, Seaforth, Simcoe, Springfield, ratford, Strathroy, St. Catharines, St. George, St. Mary's, ndwich, Streetsville.

Tavistock, Thamesford, Thamesville, orndale, Tilbury, Tillsonburg, Toronto.

Walkerville, Wallaceburg, Waterloo, aterdown, Waterford, Watford, Welland, Wellesley, W Lorne, Weston, Windsor, Woodbridge, Woodstock, Wy ing.

Zurich.

Montreal Tramways anchise

Complying with the requests of s ral deputations, the Quebec Government have appointed ommission, consisting of Senators J. P. B. Casgrain and harles Beaubien, Mr. A. Verville, M.P., Mr. Charles La ieau (chief city attorney of Montreal), and Mr. P. J. C burn, of the Bank of Montreal, to settle a new franchise the Montreal Tramways Company. The Montreal Con llers and the company have been conferring for several w ks on the subject, but progress was very slow and an eement seemed to be improbable. It was alleged that riv financial interests made a settlement impossible. The C mission have power to prepare a contract between the par s, after making inquiries, the total cost being borne equall y the city and the company. The new franchise is to for 36 years, that is, 30 years beyond the present franchi At the expiration of this period, and also at the expirati of five years subsequent, the city will have the right to uire the tramways undertaking by paying the value as ed by arbitrators and ten per cent. additional for goodw One point in the agreement made by the Governme to which objection is taken is that while the city is boun o accept the findings of the Commission, the company ar free to refuse them, as the new franchise will not come o operation until the contract is signed by a majority of th ommission and the president and secretary of the compan

Hydro-R ial By-Laws

A by-law will be subm d at the new year covering two definite hydro-radial prop tions, the first being a Welland to Bridgeburg line and th econd a Port Credit to St. Catharines line.

The Welland-Bridg rg line is estimated to cost $2,208,716, and the corpo ions interested and who will vote on this by-law are the llowing: Township of Crowland, Township of Humberst e, Township of Bertie, Village of Humberstone, Village Port Colborne, Village of Fort Erie, Town of Welland nd the Town of Bridgeburg.

The line from Port redit to St. Catharines is estimated to cost $11,360,363, an he by-law will be submitted to the municipal corporation of the Townships of Toronto, Trafalgar, Nelson, East F nboro, West Flamboro, Barton, Saltfleet, North Grimsby, inton, Louth, Grantham, the Villages of Grimsby and Bea ville, Towns of Oakville and Burlington, and Cities of Ha lton and St. Catharines.

The route of th Welland-Bridgeburg line will be from East Main Street in elland to a point meeting the Michigan Central bridge at th Welland Canal; east through Humberstone and Port Co rne to a point south of Sherks; thence south-easterly to C stal Beach, and then following the Grand Trunk Railway pa Crescent Beach and Erie Beach to Fort Erie. From Nia ra Street, Fort Erie, the route will be along the north si of the Erie and Niagara Railway, northward across the T. and M. C. R. tracks to Central Avenue, Bridgeburg.

The route of he Port Credit-St. Catharines line will be from Port Credit to Clarkson, to Oakville, to Burlington, and Hamilton. From Hamilton the line will run in close proximity to Stoney Creek, Fruitland, and Winona, from which latter point it will parallel the G.T.R. through Grimsby and thence southeasterly through Beamsville and Jordan to St. Catharines.

Companies Entitled to Compensation

A proposal made by the city of Montreal to set aside the arrangement with the public utility companies in the matter of removing wires, poles, and overhead equipment has been eliminated by the Private Bills Committee of the Quebec Legislature. The city proposed that the companies should remove this equipment, when ordered by the Council, without compensation, and that the indemnities already paid, after deducting the amounts realized by the sale of the materials already expropriated, should be added to the cost of the underground conduits and form part of the debt which is being paid off by the companies in the form of rental for the use of the conduits.

Naturally the Tramways Company, Montreal Light, Heat, and Power Company, and Montreal Public Service Corporation objected to this proposal, which, if passed, would take the place of an agreement, sanctioned by the Legislature, under which the companies contribute to the cost of the removal of the wires, poles, and equipment. It is expressly laid down that the companies are entitled to compensation. The conduits, it was argued, are for the benefit of the city, and the companies' contention was that the cost of the change from overhead to underground ought to be paid by the city; however, the companies had to pay a proportion, and it was almost effrontery, declared Mr. Montgomery, K.C., for the city, to attempt to get out of their share. It was mentioned that it had cost the Montreal Light, Heat, and Power Company $112,500 to change the system on St. Catherine Street, while the amount received as compensation was only $42,836.

Vancouver Island Water Powers

At a meeting held under the auspices of Victoria Board of Trade, November 22nd, some interesting information relative to the water powers of Vancouver Island was given by Mr. William F. Best. While only about 40,000 h.p. is at present being utilized, the speaker claimed that at least 500,000 h.p. is available, and in order to foster new industries the government should disallow the holding for speculation of lands on which are located rivers that might be harnessed for the driving of machinery.

The speaker pointed out that there was a great future for many new industries in British Columbia, and that the importance of the province's almost unlimited supply of water power was an asset that could not be emphasized too strongly. He mentioned that carbide, manufactured from coal and limestone, graphite, bisulphide of carbon, carborundum, aluminium, bauxite, and other substances, all of which are now of great commercial value, were among the products of plants in various parts of the world where electric heat was generated by water, and there was no reason why these industries should not be introduced eventually in British Columbia, where both the minerals and water power were available. The fixation of nitrogen from the air was another process that should receive encouragement, on account of the province's natural potentialities. Water power should also aid in the production of iron, copper, lead, zinc, coke, coal tar, benzine, carbolic acid, in addition to the many materials that are already being shipped by British Columbia to the markets of the world.

Among the big British Columbia rivers that had not as yet been harnessed for the driving of machinery were the Telkwa, Bulkley, Skeena, Stikeen, Nechaco, and Peace.

Electrical Section Canadian Society of Civil Engineers

The following papers are to be read to the members of the Electrical Section of the Winnipeg Branch of the Canadian Society of Civil Engineers during the remainder of the season of 1916-17:—

3rd Meeting, December 13th, 1916.—"The Railway Convention," G. L. Guy.

4th Meeting, January 10th, 1917.—"Automatic Printing Telegraph," H. McConkey.

5th Meeting, February 14th, 1917.—"Train Lighting System," A. C. Turtle.

6th Meeting, March 14th, 1917.—"Re Call System of Telephony," H. E. Brockwell.

7th Meeting, April 11th, 1917.—"Electric Furnaces," A. M. Tirbutt.

8th Meeting, May 9th, 1917.—"Efficiency Test made on a 25,000 h.p. Water Wheel Connected to an Electric Generator," F. F. Griffin.

Papers That May Be Substituted if Necessary

Mr. Bisch, on "Electric System for Automobiles."

J. W. Dorsey, on "The Mercury Arc at Constant Pressure."

In addition to the above the Research Committee provide a ten-minute talk at each of the above meetings on some new heating device or invention; in this way the members are kept fully posted on all new ideas of importance.

Coast Had First Interurban System

Just 25 years ago last October interurban electric cars—the first in Canada—began operating between Vancouver and New Westminster, according to "The Buzzer," the interesting little paper issued by the British Columbia Electric Railway Company for distribution among its patrons.

The Vancouver street car system was started up the year previous—in 1890, to be exact. It was originally intended to operate horse cars, and four of these had been secured, but by that time electric cars had been invented, and the company installed motors in place of horses. The trackage at the outset gave a rather limited service—the rails ran from Dufferin Street down Main, along Powell to Carroll, then on Cordova to Cambie, and on Hastings to Granville to Pacific. Another line ran along Powell as far as Campbell Avenue, near the present site of the sugar refinery. One of the oldest men in the service of the B.C.E.R. says: "I remember the first day we ran just as well as if were yesterday. It was the first of July, and we took in $62.75. One of the men at the barn has the first nickel—it was all five-cent fares in those days and no transfers. Having no repair shops, they just took off a car when anything required fixing—sometimes there was only one car running, but as there was no schedule it didn't seem to worry anyone. The cars only had two 10 h.p. motors, and when negotiating a hill it often happened that a few of the passengers would have to get out and shove. We'd sometimes stop seven or eight times in a block to take on or let off passengers. A man standing in the doorway of a store would signal to the car and it would wait for him. Discipline was easy in those days. On one occasion that I remember the car crew, on one of the late trips, halted the car in front of a restaurant while they tucked away a steak supper. We usually ran to between 11 and 12 o'clock at night; when we made up our minds to quit, we told everybody to pile out—we were going to the barn. Sometimes we agreed to make another trip, in which case fares had to be paid over again.

"When the cars ran up Main Street hill to Broadway, a good many years after they first opened up for business, it was a usual thing for housewives at the top of the hill to give the motorman or conductor a quarter to buy some beefsteak at the butcher's down-town, and the carmen would deliver it when they came back next trip. It was a long time before the line ran down to English Bay. The West End was all bush, of course, and for a good many years after the wagon track on Davie only went as far as Thurlow, then you struck through the bush for the beach."

Vancouver City May Develop Hydro-Electric Power at Bridge River

With the object of placing the city in an independent position when the present agreement with the British Columbia Electric Railway Company for light and power comes to an end in 1919, Vancouver City Council on December 6th ratified an agreement entered into at a private session held November 29th, which authorized the taking of an option on one of the largest water powers in the province—Bridge River, near Lillooet, 150 miles from Vancouver, which is capable of an ultimate development of 400,000 h.p. or better. The power rights are controlled by Engineer W. R. Bonnycastle, of Vancouver, who has agreed to sell out to the city at the figure of $40,000. The council will apply to the legislature at its next session for charter amendments which will empower it to proceed with the work of power development. Should the electors at some future time decide to empower the city to develop this water power to which the city has now secured the rights, it is intended that the city should have the rights to manufacture nitrogen fertilizer from the atmosphere by electricity—only commercially possible where a large amount of cheap power is obtainable. These and other rights in addition to the supply of electrical energy for light, power, and traction, will be sought in the pending charter amendments, as the city does not possess these rights now.

Alderman Gale epitomized the situation when he said the present action of the council had for its object simply to provide the city with the necessary power or right to provide light and power when the present agreement with the B.C.E.R. expired. In that connection all that the city was asking the government to do was to eliminate three words in the existing franchise agreement with the B.C.E.R. These three words at present barred the city's right to "purchase, acquire, or construct" anything in the nature of a power plant to develop electrical energy.

Facts About the new Water Power.

The water power plant to which the city would thus secure exclusive rights would include the erection of a dam on the Bridge River, about twenty miles south of the town of Lillooet. Depending on the height to which this dam is raised is the amount of the horse power generated. Three successive stages of development are suggested, the first comprising the development of 60,000 horse power, the second 200,000 horse power, and the third or ultimate stage of development would allow of the generation of at least 400,000, and possibly 500,000, horse power. After damming the Bridge River at a point some 160 miles from Vancouver and 13 miles west of Lillooet, the water storage thus created would be tapped by a tunnel 2½ miles long. This tunnel would convey the water through a mountain to the forebay. The penstocks would run at a steep angle for a distance of 2,800 feet to the power house, which would be located on the shore of Seaton Lake, and close to the tracks of the Pacific Great Eastern Railway. The storage basin would have an elevation of 2,210 feet, while the elevation of the power house on the shore of Seaton Lake would be only 970 feet, giving a head of 1,240 feet, or equal to a pressure of about 250 pounds per square inch at the nozzle of the penstocks.

What It Would Cost.

The estimated outlay for the three successive stages of development of this water power, as given by Engineer Bonnycastle, were as follows:

To develop 60,000 horse power, including plant complete, transmission line to Vancouver, following the route of the P. G. E. to North Vancouver, and delivery of electric power in Vancouver, $2,580,000.

The second stage, comprising the development of 200,000 horse power, including the acquisition of land for water storage and land in the watershed, as well as site for power house at Seaton Lake and a steel tower transmission line to Vancouver, complete, $8,400,000.

The third or ultimate stage of development to generate at least 400,000 horse power would comprise mainly increasing the height of the dam on the Bridge River and providing for increased water storage, involving purchase of additional land, cost $8,980,000.

These sums comprise the total estimated outlay; that for the second stage including the amount for the first, and the same rule applying to the third stage.

Toronto Section A.I.E.E. Hear Address and Discussion on Latest Electric Railway Developments

A meeting of the Toronto Section of the American Institute of Electrical Engineers was held on Friday evening, December 15th, 1916, in the Engineers' Club.

The Chairman, Mr. E. T. J. Brandon, first introduced Captain Matheson, Royal Canadian Engineers, who has just returned from the front on sick leave after having spent some eighteen months in the trenches. Capt. Matheson outlined the work of the engineer at the front, bringing out the point that the sapper or private in the Engineers held an extremely important position, as at times he was required to have charge of a working party from the infantry of anywhere from fifty to two hundred men. Lieutenant Armer, of the Royal Canadian Engineers, explained what they were trying to do in recruiting in Toronto, and asked for the assistance of the members to aid in this work. The chairman assured the officers that they would receive the hearty co-operation of the members present.

The chairman then introduced Mr. G. H. Hill, assistant engineer, Railway & Traction Department of the General Electric Company, who was the speaker of the evening, on the subject "Railroad Electrification."

In taking up this important subject Mr. Hill explained that the electrification of tunnels and terminals of railroads did not bring out the true economic significance of electrification. He explained that the installation at Butte was the first that had brought out important points as to the economic value, but that the electrification of the Chicago, Milwaukee and St. Paul in the mountain districts has been a mile post passed in the path of the real work of the electric locomotive. This electrified section is 440 miles long and parts have been in operation for two years. The speaker then showed slides of the contour of the electrified section and also giving the details of the locomotive, explaining the gear drive, the cooling of the motor, the contactors and pantagraph. Slides were then shown of the sub-station. The power for this system is received over five transmission lines at 100,000 volts from the Montana Power Company, whose power plants are on the Missouri River. There are fourteen sub-stations, approximately thirty-one miles apart, and having an installed capacity of 59,500 kw. The speaker drew attention to the necessarily low capacity of the sub-station equipment and also advised that this equipment was capable of double the present traffic. Details were then given of the motor generator sets, the rating of these sets being three times full load current for five minutes. The reason for this rating is that freight trains will take a very excessive current for about five minutes. Details of the switchboard were then explained and the new quick-acting breaker was explained in detail. The object of this breaker is to relieve the system of short circuit and prevent flashing over.

The film "The King of the Rails," was then shown. This film outlined the progress in transportation from the earliest times. It then showed the King of the Rail—the electric locomotive. Views of the Erie shops of the General Electric Company were then given, bringing out the different points in the manufacture of the locomotive. The audience was then taken for a trip over the Chicago, Milwaukee and St. Paul, first being shown scenes from the top of the locomotive showing the pantagraph in operation; scenes were then shown from the front of the cab of the locomotive as the train was going through the mountains, views of the power plants supplying power for the lines and different sub-stations showing interior views and also the bungalows for the men, and in general a very comprehensive idea of the operation of the railway.

Mr. Hill then explained the trouble encountered in metering power that was being supplied a number of different points, explaining that this was overcome by the use of calibrated wire, the master meter being in the office of the despatcher. He also explained that by use of this wire and relays the load despatcher had absolute control over the lowering of voltage at time of peak and thus control of peak. An outline was then given of regenerative braking. This method was taken up first due to the difficulties of braking a freight train over the mountains with air, but as the work has been carried on unexpected advantages have been shown. For instance, it requires 31 watt hours per ton mile to take a freight train over the mountains without regenerative braking, whereas with regenerative braking this can be done for 23 watt hours per ton mile. Twenty watt hours per ton mile are required to transport the same freight train on a level track. From this and other data, the officers of the road could well say that "Electrification has eliminated the Rocky Mountains."

Discussions were contributed by Messrs. Brandon, Pannell and Henderson. One of the points explained was the use of the copper shoe on the pantagraph running on a copper trolley. Mr. Hill pointed out that early difficulty of excessive wear was due to rigid suspension of the trolley, causing hard spots. The matter of the suspension of the motor and method of driving were also explained, also details of arc supression by the quick-acting brake.

Montreal Weekly Luncheon

Mr. R. H. Bertrand, credit manager of the Montreal Light, Heat and Power Company, was the speaker at the Montreal weekly electrical luncheon on December 20. His subject was "Credit." Mr. Bertrand alluded to the scientific basis on which credit had been placed in recent years, replacing the old hit and miss methods which were formerly in force. The new methods enabled credit men to forecast with accuracy the percentages of losses which might be expected. While most people were honest, the true test came when adverse circumstances threatened men, and when it needed sacrifices to meet their obligations. The risks of loss were comparatively light with those in a small way of business; bankers and others knew that the bad losses were made with the larger houses. Credit was really determined by character. Mr. Bertrand also analyzed the relation between salesmen and credit men, and between the collection department and the credit department. The attendances of the luncheons have kept up very well. The subjects dealt with are very wide, and are not necessarily technical; indeed some of the most interesting have been on general lines. The following are the future speakers: Jan. 3, Mr. J. A. Anderson, traffic manager of the Bell Telephone Company; Jan. 10, Mr. C. H. Loomis, sales and advertising expert, Montreal; Jan. 17, Mr. Murphy, C. Gurd & Co.; Jan. 24, A. J. Felton, Alexander-Hamilton Institute, New York; Jan. 31, Mr. R. J. Younge, Montreal; Feb. 7, Mr. B. Wheelwright, signal engineer, Grand Trunk Railway; Feb. 14, Mr. G. Macdonald, Canadian General Electric Company; Feb. 21, Mr. A. E. Thornton, Canadian Consolidated Rubber Company; Feb. 28, Mr. J. Hughes, electrical engineers' department, C. P. R.; Mar. 7, Mr. A. Brown, Canadian Westinghouse Company; Mar. 14, Mr. D. McMahon, Bell Telephone Company; Mar. 21, Mr. H. Hulatt, manager, Grand Trunk telegraphs.

The Electric Club of Toronto

The members of the Electric Club of Toronto were very agreeably entertained at their Friday, Dec. 8, luncheon at the Prince George, by Mr. C. C. Bothwell, who demonstrated, by motion pictures, the various processes in the manufacture, crating, and shipment of lamps as carried out by the Laco-Phillips Company at their works in Eindhoven, Holland. Mr. Bothwell introduced the matter in a short address, in which he pointed to the wonderful developments that have taken place within recent years in this phase of the electrical industry, reviewing also briefly the simultaneous development of his company.

The last luncheon of the year was held on the 15th, at which Mr. Groome had provided a programme in keeping with the holiday spirit. Music was provided, and the members were given the opportunity of delighting their own ears with some of the old-time melodies and choruses. "Johnnie Courteau," "Britain at War," and other selections were sandwiched in between the musical items by Mr. John Alexander, who, as usual, greatly pleased his audience.

The single item of business came up in a motion offered by the secretary, that the club, during the coming year, should seek to enlarge its activities, (1) in naming and advertising a slogan for Electrical Toronto; (2) in a movement towards (a) holding an "electrical week," (b) procuring an electrical building at the Canadian National, and (c) interesting the daily press in the "electrical page" idea. The motion was discussed at some length and finally handed over to the management committee, who will make a report. The programme for January follows:

Syllabus of Half-Hour Talks

Before

THE ELECTRIC CLUB OF TORONTO

During the Month of January, 1917

FIRST FRIDAY—Rev. Byron H. Stauffer.
SUBJECT—"Does the Golden Rule Conflict With the Slide Rule?"

SECOND FRIDAY—Captain Matheson, M.C.
SUBJECT—"Experiences of a Canadian Engineer at the Front."

THIRD FRIDAY—Mayor Church, City of Toronto.
SUBJECT—"Toronto."

FOURTH FRIDAY—R. C. Harris, Commissioner of Works, City of Toronto.
SUBJECT — "Transportation" (postponed from Nov. 17, 1916).

Walter R. McRae, Chairman.
Frank T. Groome, Secretary-Treasurer.

Telephone Pioneering Work in Canada

Some Interesting Reminiscences of the Early Days Related Before the Telephone Pioneers of America at Atlanta, Recently

By Mr. L. B. McFarlane*

No adequate record has been kept of the beginning of things telephonic in Canada, and I shall not attempt the task. But it may be that some reminiscences of the early days of development of the art in Canada will be found worthy of place in our Society Journal.

The subject of this paper has been chosen because we, as Canadians, feel that we have an interest equal to Americans in telephonic history, the telephone having been first conceived in Brantford, Ont., where many of the early experiments were successfully carried out by the inventor and where some of the first knotty problems were solved.

While Professor Graham Bell was still seeking a means of bringing his invention to perfection and rendering it commercially satisfactory, he gave to his father as a present a three-fourths interest in the Canadian patent yet to be granted—a rather unusual instance of filial regard and affection and one to be commended. When the patent was issued, a General Agent was appointed by Professor Melville Bell to control the Canadian field, and the business started as a private line enterprise.

Hamilton Begins Early

The first telephone contract secured was taken at Hamilton, Ont., 18th of October, 1877, and the line, forming part of the local District Telegraph call system, was equipped with six telephones and first tested on the 29th of August, 1877. The press of the day announced that this was the first instance in which more than two telephones had been operated satisfactorily on one circuit.

The opening of this line was attended by Professor Graham Bell, his father, Professor Melville Bell, and his uncle, Professor David Bell, all of whom expressed their surprise and delight on the successful operation of six telephones on one circuit.

The satisfactory talking qualities of this line immediately led to the opening at Hamilton of the first Exchange in Canada, and the second in the world, by the Hamilton District Telephone Company on its call box circuits. The license to operate was granted on the 28th of May, 1877, and the first line opened on the 18th of October, 1877.

About this date attempts were made to talk simultaneously on two circuits from Hamilton to Dundas, five miles distant. The cross-talk was very troublesome. Professor Bell being appealed to for help recommended that each insulator on the line should have a zinc thimble between it and the crossarm. This was tried, but no improvement was noticeable, and the cross-talk continued until metallic circuits were built.

Early Efforts After Subscribers

The inducements offered to attract subscribers at that early date appear to us as highly absurd. A circular issued in February, 1879, at Hamilton, requested subscribers to send orders or short messages to the operators to transmit to subscribers for whom they were intended. This was to be done whenever the subscriber did not particularly desire his line to be connected, but the company stipulated in the circular that it could not guarantee correctness as its business consisted of putting subscribers in communication with each other. One can realize what a staff of operators would be required today under these conditions.

One of the first inducements offered the public at Hamilton was a time service to correct clocks at noon each day. At that hour a signal was sounded over the lines from central by means of a stick simultaneously pressing on and closing fifteen keys, one to each line. This service was soon abandoned as the lines outgrew the length of the stick.

Early Long Distance Lines

The first long distance line test in Canada took place in 1876, when Professor Graham Bell applied to the Dominion Telegraph Company for a permit to test his embryo telephone on its telegraph line between Paris and Brantford. When the formal application was received, the general manager of the Telegraph Company handed his assistant the letter with the remark, "Another of those cranks; consign it to the waste-paper basket." But the assistant, scenting a source of profit, suggested that the line be rented for an hour, which was done. Needless to say the rental was never collected, as the talking, though possible but one way at a time, was successfully carried out, and it led to the Dominion Telegraph Company acquiring a license to operate the Bell Telephone Patent in Canada for a period of five years, from 18th of February, 1879.

The first commercial Long Distance Line test in Canada was made on September 1st, 1877, a distance of 125 miles, between Montreal and Brockville, but it was not successful, as the listeners on the line reported that the principal sounds heard were like the noise in a riveting shop.

On the 20th of September, 1877, a successful conversation was carried on by Edison telephones between Montreal and Quebec, a distance of 200 miles. This was certainly a record talk for that period.

On the acquisition of the Bell patent by the Dominion Telegraph Company, its competitor, the Montreal Telegraph Company, acquired the Edison patent. Keen competition for exchange business immediately ensued, and as this attitude meant a fight to a finish, exchange telephone service in Canada could be had in the year 1879 almost for the asking.

"Go and Find Out"

The writer was appointed Superintendent of the Telephone Department of the Dominion Telegraph Company when the patents were acquired. Upon asking for instructions and information as to his duties he was told to "go and find out," that being all the lead they could give him. There was no one to go to who had a knowledge of the business, and he, therefore, had to grope in the dark. If the axiom holds good that "knowledge is the basis of all intelligent effort" the pioneers of the telephone industry started with the greatest possible handicap, as the lack of information was appalling. No one then had any knowledge of the Art. The man who started the business could not teach those entering it as all alike were ignorant of even the first principles of its methods and operation. There was no literature on the subject to turn to, no electrical engineers to consult, practically no electrical manufacturers to build subsidiary apparatus and no skilled help to be had. With all of these drawbacks, devices to operate had to be and were promptly provided, to get over what appeared to be at times insurmountable obstacles. Possibly one of the reasons why the telephone business has become almost the greatest in America is the fact that we have had to hew out a new road from the start, not depending upon any other industry, and much of the credit for success is due to the early pioneers who cleared the way.

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Early Instrument Trouble

As an instance of the obstacles one had to contend with I recall my first view of a telephone when Professor Melville Bell brought a number of wooden box telephones to Toronto. In addition he had other boxes containing vibrating reeds which made a rattling noise and were used for signalling purposes. The only electric signal arrangement known in those days was a signal type of bell and vibrating reed worked by a closed circuit battery. These were unreliable and had serious limitations. Professor Melville Bell's journey to Toronto was undertaken to get advice as to signalling apparatus from the telegraph men there, as, without good calling apparatus, the telephone could not be marketed with success.

When the Telegraph Companies entered the field, they decided that the best way to develop exchange business was to plant telephone systems in the various towns and cities regardless of cost or returns. A blanket order was given to cover as much territory in as many cities as possible before the other fellow. The fight was on. But a remarkable condition was found and one worthy of record. The successful talking of the commercial electrical telephone had caused some unscrupulous parties to enter the smaller towns and sell sound box or acoustic telephones, made out of or similar to a cigar box and connected together with piano wire. This third and troublesome competitor was found in numerous places with wires up and doing business. It was difficult in some cases to convince the public that these were frauds, and it took time to displace them.

Keen Competition

The competition between the Telegraph Companies was so keen that in canvassing, their representatives quoted rates hardly believable today. At St. John, N.B., one company abandoned the canvass for subscribers after two weeks' vigorous work with only one subscriber secured. The other company, fearing defeat, announced its proposed opening of service on a free basis for three months, the telephones to be then removed if not satisfactory. But, alas, they could not secure telephone apparatus in time, and the first company, which had abandoned its canvass, learning of this move, sent by express a distance of 1,000 miles a complete outfit to St. John, N.B., erected its exchange and gave the free service promised by its competitor. It is needless to say that no subscribers were lost when, later on, a rate schedule was put into effect.

At Ottawa, both the Telegraph Companies' representatives actively canvassed for exchange subscribers without success, but one company was so confident that they shipped in ahead with the canvassers a complete exchange outfit.

The canvass was a failure and the supplies had to be stored, until the public were in a more receptive frame of mind, or, in other words, until they saw other cities and towns had secured telephone service.

Montreal's First Exchange

The first Bell Telephone Exchange in Montreal was opened in a room 12 ft. by 14 ft. floor area with a prospective list of 56 subscribers. The Manager went to New York to buy a switchboard. Tillotson's and Bunnell's were the only electrical firms in business to whom he ccould apply. Tillotson had not manufactured any telephone apparatus, but claimed to have prepared a drawing of a suggested switchboard. The drawing when produced proved to be a rough pencil-sketch on wrapping paper. After a query by the manager as to the length of the proposed board, its dimensions were given supposedly in inches, but, on receipt of the switchboard, the length given proved to be in feet. The board when unpacked was found to be so long that a special building would have been required to house it. A way out was found by cutting the switchboard into three parts, one part bent around the room in circular form was placed in the Montreal exchange and the other thirds formed the first switchboards used at Quebec and Halifax.

Non-Vibrating Bells

Another difficulty which then beset us was that subscribers' station bells in quantities could not be bought ready made at the initiation of exchange service. An order for 500 vibrating bells was given to a Toronto electric company working in a small way on telegraph apparatus. These bells were distributed throughout the exchanges under construction, and although "vibrating" bells, when placed on subscribers' stations they failed to vibrate. Complaints came in a deluge from managers. Tests showed that the ringer core had been made of ordinary hard iron which permanently magnetized on passage of current, causing the ringer to stick and the public to kick! The excuse offered by the would-be manufacturing electrician was that he thought the quality of iron in the ringers would make no difference, but it postponed the opening dates of several exchanges.

These bells probably constituted the first "junk" pile, which has since been such a pronounced feature in telephone science.

Bell Company Enters the Field

The Bell Telephone Company of Canada entered the field in 1880 and operated in all the provinces except British Columbia. That company purchased the various competing interests, thereby consolidating the exchanges, but the opposition element would not be gainsaid, and, in the early eighties, some isolated Bell exchanges were threatened with demoralizing competition.

Our honored President, Mr. T. N. Vail, had been a director of the Bell Company of Canada from its inception and his advice was sought. After studying the situation for a few minutes, he called for a map of the provinces of Quebec and Ontario and with a blue pencil drew lines from Montreal to various Canadian cities and towns within a radius of 300 miles. The manager, whose longest toll line barely exceeded 20 miles, gasped when Mr. Vail remarked, "Build Long Distance lines at once to connect all the exchanges within this territory." "But," objected the manager, "they will not pay." To this Mr. Vail responded, "I did not say they would, but they will unify and save our business," and the early erection of such lines did consolidate our system to such an extent that competition has ever since been negligible.

A Newfoundland Story

In 1883 a representative of the Bell Telephone Company visited the ancient colony of Newfoundland and learned that neither Bell nor Blake had applied there for patents to protect their inventions. They apparently were under the impression that the Canadian Company's charter and rights governed in that territory, but, as this was not the case, patents were applied for by the Bell Company. Some idea of the prospective value of such a patent may be gleaned from the fact that the consideration paid Dr. Blake for his Newfoundland transmitter patents was one Russian sleigh of the best quality that could be manufactured in Canada.

The Bell Telephone Company's representative, having secured patents in Newfoundland, applied to the local government for a charter to operate, but met with keen opposition from the Anglo-American Telegraph Company, which claimed exclusive rights under a fifty-year telegraph agreement. The local government under pressure from the Anglo-American Company refused, after three months' delay, to grant the charter, although they had promised to do so. The position then was that the Bell Company held the patents and the Anglo-American Company the working charter. A deadlock seemed imminent, but the Bell Company's representative offered the use of the patents to the Anglo-American Company on a royalty basis, which was promptly accepted. When the manager of the Anglo-American Company was asked why he had opposed the introduction of the Telephone, his explanation was unique. He said that from press reports and a chance remark of the Bell Company's representative he had concluded that we had discovered a way to telephone across the ocean and he thought this was the secret reason for taking out patents in such an out-of-the-way colony. He had cabled his views and conclusions to the London office and was promptly ordered to oppose our application at all costs. When assured that he had jumped to a wrong conclusion and that telephonic transmission across the sea was impossible, he was quite satisfied to reach a working agreement.

One could go on reciting many instances of the trials and tribulations of the early pioneers, but enough has been said here to show that, through great and almost endless difficulties, we have laid a good and proper foundation for others to build upon.

Literature for the Business Man

"What Can Literature Do for the Business Man?" was the subject of an address by Mr. L. McMahon, of the Bell Telephone Company, at the Montreal Electrical Luncheon on November 22. He spoke of the materialistic opinion of life which predominated in Germany, which had resulted in the restricted view of the rights of others and all that this meant. Mr. McMahon asserted that we, too, were seriously affected by materialism to the neglect of the humanities. In the United States especially, many men who were specialists in different lines had become, by reason of the study of their particular departments, very narrow even in their own lines. A study of literature would give a wider outlook on life, give a vision of the ideal, a better knowledge of human nature, restore the past to us, and give a better knowledge of our own language.

Sickness vs. Accident

Dr. Chas. A. Lauffer, Medical Director of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, has recently delivered before medical societies, Safety-First and Welfare Conferences, a series of papers dealing with disease and acidents in industrial plants, that have been favorably commented upon by the medical profession. Among these papers is one on the subject of "Sickness versus Accident," in which the author draws the conclusion, based on a wide experience in the Westinghouse plant, of the tendency of the employee to attribute ailment to accident rather than to sickness, thereby making the company liable for compensation damages which would not be the case were the ailment to be due to sickness. Dr. Lauffer has also presented papers on the subject of "Hernia" as an anatomical defect rather than an accident, and produces evidence from his own experience as well as letters from a number of prominent physicians to substantiate his arguments.

Using Nitrogen Lamps Exclusively

New Westminster may claim the distinction of being the first city on the Pacific Coast to be lighted exclusively by nitrogen lamps, Victoria and Vancouver not yet having completed the remodelling of their systems. City Electrician Digby, of New Westminster, completed his work in November, and since then has been making a careful list of operating costs. Under the arc lamp system the cost of street lighting [illegible] at [illegible] cents, [illegible]; carbons, $1,209; glassware, $400; repairs, $550; trimmers' [illegible] $800; total, [illegible]. With nitrogen lamps the cost is estimated as follows: 260,132 kw. at 1¼ cents, $3,621; installing new lamps, $911.42; renewals per year, $500; total, $4,673.07. The saving in current alone is thus over $5,000 and the total saving over $7,000.

Light and Power Rates in New York

The following is the proposed new rate schedule of the New York Edison Company and United Electric Light & Power Company, which goes into effect January 1, 1917, in accordance with an agreement with the New York Public Service Commission. A further reduction of the maximum rate from 7.5 to 7 cents and consolidating the general and power rates under one schedule may be made July 1, 1917, if conditions warrant:

GENERAL RATE

Rate on Dec. 31, 1916 Kilowatt-hours	Cents	Rate after Jan. 1, 1917 Kilowatt-hours	Cents
First 900	8.0	First 900	7.5
Next 100	7.0	Next 100	7.0
Next 200	6.0	Next 300	6.0
Next 300	5.0	Next 600	5.0
Next 400	4.5	Next 600	4.5
Excess over 1,900	4.25	Excess over 2,500	4.25

POWER RATES

Rate on Dec. 31, 1916 Kilowatt-hours	Cents	Rate after Jan. 1, 1917 Kilowatt-hours	Cents
First 450	8.0	First 600	7.5
Next 100	7.0	Next 100	7.0
Next 1,350	6.0	Next 700	6.0
Excess over 1,900	4.25	Next 800	5.0
		Next 1,100	4.5
		Excess over 3,300	4.25

New Books

Telegraphy—by T. E. Herbert, A.M. Inst. E.E., engineer British Post Office Engineering Department; third edition, thoroughly revised and enlarged; 630 illustrations; Whittaker & Company, of London and New York, publishers; price, 9s. net. The first edition of this work claimed for its object the supplying of an up-to-date and detailed exposition of the telegraphic practice of the British Post Office and also to provide for the requirements of the Departmental and City and Guilds' examination in the subject. The third edition is made necessary on account of the many advances during the past ten years in the science of telegraphy. The scope of the work can be gathered from the following chapter headings: The Fundamental Principles of Magnetism and Electricity and Units; Primary Cells; Calculations in Connection with Circuits and Conductors; The Measurement of Current; The Measurement of E. M. F. and Battery Testing; The Measurement of Resistance; Single Current Systems and Relays; Capacity, Condensers, and the Double Current Sounder; The Differential Duplex; The Quadruplex; The Wheatstone Automatic System; The Bridge Duplex; The Wheatstone A.B.C., Steljes Recorder, and Rebesi Typewriting Telegraph; The Hughes; The Baudot; The Murray Automatic and Murray Multiplex Systems; General Battery Telegraphs and Telegraph Switching Systems; Secondary Cells; Secondary Cell Working; Repeaters; The Test Box and Protective Devices; Telegraph Testing and the Formation of Special Circuits; The Construction of Aerial Wires; The Construction of Under ground Lines.

Examples in Alternating Currents—Vol. I., by Professor F. E. Austin, Hanover, N.H.; published by the author; price, $2.40 net. The object of this book is to assist students who are pursuing courses in electrical engineering, to apply fundamental principles in engineering practice. It is also designed to help those who may be pursuing correspondence courses or attempting the study of alternating currents without tuition of any kind. There are 220 pages, size approximately 5 in. x 7 in.; an appendix contains a number of valuable tables

Electric Railways

Notes on Heavy Electric Traction—Experiences of Operating Systems—Important Advantages of Regenerative Braking on Mountain Sections—Larger Tonnage, Better Schedules, Greater Economies

By Mr. J. A. Shaw*

The rapid replacement of all motive power by electrical or street railways and the mushroom-like growth of light interurban electric railways in the more closely settled districts of this continent has aroused a general feeling that a similar revolution would occur with steam-operated railways. Conditions, however, are radically different with the latter. In the case of the former the ability to furnish speedy units for facilitating the passenger transportation has provided a more remunerative return. In the case of the majority of steam railroads the freight service furnishes the most profitable return, and, due to its inherent greatest deficiency being in the moving of large units, the application of electric power is made more difficult. However, with the growth of the country the main problem is now becoming how to make better use of existing track facilities, especially where there is difficulty in increasing trackage in main terminals. Therefore, due to the almost unlimited power possible to concentrate for propulsion with electrical power, train speeds may be increased with consequent greater frequency of movement, and the importance of an electrical solution in relieving traffic congestion has recently been demonstrated successfully in both passenger and freight service. This also in the face of rapid advances in steam motive power design.

In addition the electrical locomotive has already demonstrated a power economy of one-half that of its steam opponent, as measured for equal power at the drawbar, and is now showing even a greater improvement from the new regenerative power feature. This advantage of making use of the energy otherwise lost in stopping a train is one of the first applied solutions of a problem that investors have worked at for a century or so, with varying success, from the old plan of stopping horse-cars by winding up a spring and then starting them by setting it loose to the recent successful plan of building elevated stations on a hill of track.

While the electrification of steam roads is primarily a railway problem, there is a closely-connected aspect of material interest to the country at large, viz., the result of the use of electric power by a railway will mean the availability of cheap power for light and manufacturing purposes in communities that could not otherwise have hoped for such advantages for years. The result of this must inevitably be to stimulate both trade and population, which will react favorably to the railway company as well as the district.

From the time of Spragues first successful railway experiment at Richmond, Virginia, in 1888, it has been the chief ambition of the electric railway engineer to invade the broad field of heavy traction, for many years practically monopolized by the steam locomotive.

Material progress in this direction has marked the intervening years, but only recently has the electrification enthusiast reached the height of his ambition. The crowning achievement in the great struggle to supplant the steam locomotive has been attained in the complete electrification of the mountain divisions of the transcontinental lines of the Chicago, Milwaukee, and St. Paul Railway.

A brief review of some of the principal electrifications leading up to this great project may be of interest. The first undertaking of this kind which could be classed as heavy electric traction was the Baltimore terminal of the Baltimore and Ohio Railroad, which has been operated electrically since 1895.

The electric zone of the B. and O. R. R. lies entirely within the city limits and is a part of the so-called belt line, extending from Camden Station on the west to Waverly interlocking tower on the east, a distance of 3.75 miles. There are eight tunnels in this zone, which together constitute 48 per cent. of the total distance. The longest of these tunnels is 7,300 feet in length, and extends from Camden Station to Mt. Royal. Needless to say, the change to electric haulage wase made to eliminate the smoke and dangerous gases in these tunnels. As a matter of fact, however, the ordinance governing the construction of certain of these tracks through the city required that they be operated electrically.

The part of the zone through which trains are handled by electric locomotives is entirely up-grade, averaging .9 per cent., with a ruling grade of 1.5 per cent. Trains are handled electrically only in the up-grade direction, the locomotives returning light. Regular service was started with three locomotives, weighing 96 tons each, equipped with gearless motors. Four additional locomotives of the geared type were put in service in 1903, one in 1906, and four more in 1910 and 1912.

New York Central Terminal.

The second steam road electrification and, perhaps, one of the most important in the United States, was the New York Central Terminal, initial operations being started the latter part of 1906. The present electric zone includes 251 miles of track equipped with underrunning third rail distributed over about 53 miles of route. All through passenger trains are handled by electric locomotives within the electric zone, the change being made at Harmon, on the main line, about a mile south of Croton, and at North White Plains, on the Harlem division. Suburban passenger traffic is handled by multiple unit trains. As on the Baltimore and Ohio electrification, 600 volts is used on the third rail, power being generated in duplicate steam turbine stations, one located at Port Morris, on Long Island Sound, and the other at Glenwood, near Yonkers, on the river front. Each plant contains four 5,000 kw. Curtis steam turbine generating units, delivering 25-cycle, 3-phase current at 11,000 volts.

This current is distributed over a 11,000 volt transmission to nine synchronous converter substations aggregating over 40,000 kw. In some of the earlier substations, storage batteries are also used as a reserve and to take peak loads.

Operation was started with 35 115-ton electric locomotives of the gearless type, supplemented within a few years by twelve additional units of similar design. In 1913 and 1914 sixteen additional locomotives of a new design were put in service. These machines are also equipped with gearless bipolar motors, but are constructed with eight driving axles, instead of four, and the capacity is considerably greater than the original type. The last six locomotives, weighing 133 tons each, are probably the most powerful electric locomotives ever used in passenger service. They are capable of hauling 1,200-ton passenger trains on level track at nearly 60 m.p.h. These trains are also hauled at reduced speed up the 1.1 per cent. grades leaving the Grand Central Terminal. On account of the gearless construction of the motors they operate at appreciably higher efficiency than geared designs. It has also been found that the maintenance is very low, averaging on the entire equipment during eight years of service approximately 3½c per locomotive mile.

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In order to take care of high speed express and local suburban service multiple unit cars are employed on both the White Plains and the Harlem division. Local service requires trains of from two to eleven cars, usually made up in the proportion of two motor cars to one trailer. Suburban express trains are made up of from two to ten motor cars. These trains are capable of reaching a speed of over 50 m.p.h. and are very flexible in terminal operation, since they can be run in either directions with equal facility. There are now in service 192 motor cars and a number of trailers, each having a seating capacity of 64 passengers. These care are equipped with type "M" Sprague General Electric control and two G. E.-69-200 h.p. motors. They are of all-steel construction, 60 feet long, and weigh approximately 57 tons completely equipped.

Well-equipped repair shops are maintained at Harmon and at North White Plains, where both locomotives and multiple unit cars are inspected and repaired. The electrical equipment in this terminal service has shown remarkable reliability, there being very few interruption to traffic from electrical causes. No interruption whatever to traffic has occurred from power station troubles during eight years of operation.

New York, New Haven and Hartford Road.

The well-known installation which this railway carried out shortly after that of the New York Central now consists of a total mileage of 500, and includes 61 miles of four-track and 6 miles of six-track right of way. There are 100 passenger, freight, and switching locomotives and 69 multiple unit cars in service, which relieved 150 steam locomotives. The power service was formerly supplied from a single power house, but is now supplemented by a purchased supply from one of the New York power companies at the eastern end of zone. Certain of the passenger locomotives average 500 miles daily, and are in continuous service 24 hours daily for thirty days. In the case of switching locomotives a large number are now used in the yards of system, four electric units having been found to displace six freight switchers, principally on account of the fact that the electric switchers can be used almost continually, with no lay-over periods. The equipment on this railway was made more complicated than on any other electrified railway, due to the fact that apparatus was required to operate from alternating current on the main system and from direct current supply when within the New York terminal zone. Probably more information has been obtained in guiding electrical engineers on the design of electric railway equipment for heavy service through the work carried out on this railway than in any other similar project, and the electrical profession are under a heavy debt to the New Haven Company in this oppor[illegible] been greatly retarded without this undertaking.

Shortly after the New York Central terminal electrification [illegible] completed an electrification project was undertaken by the West Shore Railroad, a subsidiary of the New York Central system. On account of the parallel trolley lines it became necessary for this road, operating between Utica and Syracuse, to increase the capacity of the road and to develop a high-speed passenger traffic over the portion of its tracks between these two cities. The electrified section of the road is double-tracked throughout, and a third and fourth track is provided at some points to enable steam trains to pass the multiple unit trains. The distance between terminals is 44 miles, with a total mileage on a single-track basis of 106 miles. Formerly only two steam passenger trains were run daily in each direction, and at night two trains of sleepers passed over the tracks. With these tracks electrified there are fast limited cars hourly from each terminal, local cars or trains once an hour from each terminal, and also a fast freight service, which is still hauled by steam locomotives.

The electrified division is equipped throughout with an underrunning third rail, similar to that used on the New York Central terminal electrification, current being fed from synchronous converter substations at 600 volts. Power is received by four substations from the Adirondack Electric Power Corporation at 60,000 volts. Each substation contains two synchronous converters of 300 kw. capacity, each with reserve space for an additional unit.

The rolling stock equipment includes 19 four-motor multiple unit cars, which are operated either singly or in trains, as the traffic requires.

It is interesting to note that with the third rail construction used this line has never been seriously handicapped by snow. Interruptions to the service from all causes have been practically negligible, and the traffic of the system has shown a steady growth.

Electrification of West Jersey and Seashore Railroad.

One of the earlier railroads to take advantage of electrification as a means of increasing facilities for handling passenger traffic was the West Jersey & Sea Shore Division of the Pennsylvania System, extending from Camden to Atlantic City, a distance of 65 miles, and a branch from Newfield to Millville, a distance of 10 miles. The contract for the entire equipment of this railroad, including installation and the equipment, was placed in service in a little over five months, which is a remarkable record, considering the fact that included in this work were the erection of a power station, eight substations, and the electrical equipment of over 100 miles of singl track, the building of 71 miles of high-tension transmission in duplicate, and the equipment of 68 multiple unit cars. The line from Camden to Atlantic City is double-tracked throughout and at points there are three tracks. With the exception of a short stretch of track near Camden, the entire road is equipped with an overrunning third rail, operating at 600 volts, and taking power from the synchronous converted substations. Multiple unit equipment is operated in trains of from three to ten cars, without trailers. The express service between terminals operates on a headway of 15 minutes in each direction at speeds up to 60 m.p.h. Frequent local service is also provided for Camden suburbs and on the branch line to Millville.

Electricity is generated in a steam turbine station at Westville, generating 6,600 volts, 3-phase, which is stepped up to 33,000 volts for transmission. At the substations this voltage is stepped down and delivered from the synchronous converters at 650 volts to the third rail.

The power station equipment consists of 3-2,000 kw. Curtis turbo-generators, with the necessary auxiliary units. Each of the substations is equipped with two 750 kw. synchronous converters, with space for an additional unit.

The present rolling stock equipment consists of 109 motor-cars, some of which are constructed from combination baggage and smoking cars, and others for mail cars. Each is equipped with two 200 h.p. motors and type "M" automatic control. The standard passenger cars have a weight of about 45 tons and a seating capacity of 58 persons.

The operation of this electrified steam road has been most satisfactory in every way. The number of delays chargeable to electrical equipment has been less than 6 per cent. of the total number of train minutes detention, and the increase in traffic gained by the use of multiple unit cars instead of steam trains has enabled the railroad to make a remarkable increase in the number of passengers carried, on account of the local service furnished to the smaller towns and the high speed express service between terminals.

Great Northern Railway—Cascade Tunnel Electrification.

One of the most unique electrifications in the country, and the only road to use three-phase equipment is the Cascade Tunnel, on the Great Northern Railway, near the summit of the Cascade Mountains, in the State of Washington. This tunnel is 14,000 feet (2.65 miles) in length, and has a uniform grade of 1.7 per cent. In the yards at each end of the tunnel are grades of 2.2 per cent. on which all trains must be started.

Under steam operation this tunnel had become the limiting feature of the road. Heavy freight trains, requiring from two to four of the heaviest locomotives, could not operate trains faster than from seven to eight miles per hour. In the tunnel operation was still more difficult. The smoke and steam coated the rails with damp, greasy soot, causing the wheels to slip, and the smoke and gases made operation positively dangerous to train crews.

The electrification involved about four miles of route, with six miles of single track, including sidings. Power is generated in a 5,000 kw. hydro-electric plant at Leavenworth, transmitting 3-phase, 25-cycle current at 33,000 volts a distance of about 30 miles. The contact system consists of double trolley construction, carrying 3-phase, 6,600 volts a.c., using the rail and ground return for the third conductor. These overhead wires are spaced about eight feet apart in the tunnel and five feet apart in the yards. Ordinary pole trolleys are used for collecting the curent.

There are four electric locomotives, weighing 115 tons each, all of which is on the driving axles. Three-phase induction motors are connected by twin gears to each axle, and the trucks are adequately equalized to take care of twisting strains. These motors are of the three-phase induction type, wound for a primary voltage of 500, the rotors being equipped with wound secondaries brought out through collector rings. There are 13 steps in the resistance used in connection with the rotor, allowing for ample speed control. The average freight train hauled weighs approximately 2,000 tons, including both steam and electric locomotives. On down grades the induction motors automatically return power to the system when the train exceeds the normal speed of about 15.5 m.p.h.

The Great Northern has the distinction of being the first railroad electrification in this county to use regenerative braking, this feature having been in very successful operation for more than six years. The Norfolk and Western has recently begun operation, using the smae principle, and the Chicago, Milwaukee and St. Paul has adopted direct current regeneration.

This installation was made in July, 1909, and since that time all traffic through the tunnel has been handled by the electric locomotives, with the exception of delays due to avalanches and snowslides, some of which have interrupted traffic for several days at a time.

On March 1, 1910, an avalanche came down the mountain through the yards near the tunnel, carrying all the coaches of two trains, with two steam and three electric locomotives, down into the bottom of the canyon, from 200 to 400 feet away.

The electric locomotives were untouched for about three weeks duing the task of clearing the line. They were then taken to the railway companys' shops and put in operating condition. It is worthy of note that the average cost of repairs, including labor and materials on the three electric locomotives, was $962 each, while the expense of similar repairs on the two steam engines was $1,284 each.

St. Clair Tunnel Electrification.

The Grand Trunk Railway in May, 1908, replaced four steam locomotives of 100 tons with 66-ton electric units, which, as a rule, are used in sets of two. During the period that these electric units have been in service no failure has yet occurred in the main motors, and they have been available for service throughout 90 per cent. of the time. The average annual cost for the maintenance of the four steam locomotives was $21,173, while that for the six electrical locomotives has been $11,131. The average cost per car handled through the tunnel, a distance approximately five miles, by steam locomotives, was 26.6 cents, as against 17.2 cents by electrical locomotive, although the capacity of cars handled to-day is much greater than the capacity of those of 1907 and 1908. The cost of fuel for the steam locomotives was $42,000 per year, whereas the average cost of fuel consumed for generating energy for the electric locomotives is $17,000 per year. The difference in cost is partly due to the fact that slack coal is now used, whereas hard coal was used for the steam locotives. Power is supplied from one plant containing two 1,500 h.p. turbo-generator sets, and stokers of boilers are so controlled that their operation is practically controlled automatically from the operation of locomotives on the main line.

Detroit River Tunnel Electrification.

One of the most successful electrifications of a trunk line steam railroad is the section of the New York Central system now operating under the Detroit River. The two-track tunnel connecting the lines of the Michigan Central Railroad terminating at Windsor, Ont., and those in the United States terminating at Detroit, was completed in 1910, and since that time all trains have been hauled by electric locomotives through the tunnel instead of being ferried across the river. Under the old method it required about 30 minutes to make the crossing, and the facilities were very limited. With the tunnel, however, trains pass through in less than six minutes, and the capacity of the tracks is limited only by the length of train which can be handled. The general scheme of electrification includes the purchase of 3-phase, 60-cycle energy at 4,400 volts from the Detroit Edison Company and transformation in the company's substation to 650 volts d.c. At this voltage current is fed to the locomotives through an underrunning protected third rail, reaching all of the electrified tracks.

The substation is located near the Detroit end of the tunnel, and contains two 1,000 kw. synchronous motor generator sets, with auxiliary equipment for excitation and for controlling a 312 cell storage battery (capacity 630 amps. for eight hours, and momentary discharges up to 11,000 amps.). The control equipment is so arranged as to reduce the peak loads and thus obtain a practically constant load at unity power factor.

The original equipment consisted of six electric locomotives designed for hauling both freight and passenger cars through the tunnel and also for switching service in the yards. Each is equipped with four railway motors and weighs 200,000 pounds, all of which is on driving axles. The service consists of hauling an 1,800-ton trailing train from one yard to the other, negotiating a 2 per cent. grade when two locomotives are operated multiple unit. The second order of locomotives placed in service in 1914 consisted of four similar units, each weighing 240,000 pounds. The total electrified trackage now in operation is approximately 24 miles, including yards on both sides of the river and the two-track tunnel.

Norfolk and Western Railway.

The electrification of 30 miles of this road was the solution of the problem to double the capacity of a hilly section with a tunnel. The limit in capacity by the use of the heaviest steam power had been reached, and continual delays were being met with through the severe starting difficulties on grades. The latter condition arising partially through necessary stops for coal or water. Twelve electric locomotives have displaced 33 Mallet locomotives, and have increased the average speed up the ruling 2.4 per cent. grade from 6 to 14 miles per hour. The principle of braking by regenerating power has proved a complete success on this railway. The fact that the speed on down grades is constant and inflexible prevents the possibility of surges in the train, which would result in broken drawbars. The main electrical feature in this electrification was the application of the polyphase induction type of motor to locomotive axles and the use of a converter on each locomotive so as to permit operation by single-phase alternating current, and thus permit of the advantages of a single trolley wire. Trains are operated with one locomotive hauling and a pusher on the heavier grades. The method of starting is for engineer on the head locomotive to release brakes and let the slack run back. As soon as the engineer on the pusher feels the resulting blow he applies power and holds the train till the front man gets under way. This method is due to the two men not being able to signal, due to curves and train length, and works out very satisfactorily.

Suburban Lines of the Southern Pacific Company—Oakland, Alameda and Berkeley Divisions.

The suburban lines of the Southern Pacific Railroad Company, in the immediate vicinity of San Francisco, were changed over from steam to electric operation in 1911. The electrified district includes what is known as the Oakland, Alameda and Berkeley Divisions, which carry the heavy suburban traffic from the ferries to the residential districts.

Power is generated for this system in an oil-burning steam station located at Fruitvale, the generating units consisting of two 5,500 kw. turbo-generator sets delivering 3-phase, 25-cycles. Power is transmitted at 13,200 volts to two outlying substations, the third being located in the power house. Each of the substations is equipped with two unit synchronous converter sets operating two in series for 1,200 volts. Each of these sets is of 1,500 kw. capacity, there being in all ten double units in the three substations.

The rolling stock equipment consists of 81 all-steel multiple unit cars, each equipped with four 145-h.p. 600/1,200-volt motors. Trains of from two to twelve cars, made up of motor cars and trailers, are operated, depending upon the demands of the traffic.

The contact system on the Southern Pacific lines is of a flexible type, built for the use of pantograph trolleys.

Pennsylvania Railroad.

In addition to the direct current third rail electrification of its New York entrance, this railway has recently electrified surburban lines operating out of the Philadelphia Broad Street Station. This station when completed in 1881, contained 8 tracks and handled 160 trains each day, with 18 tains in the rush hour. In 1910 tracks had been increased to 16 and trains to 574, with 53 in the rush hour. Electrification has given relief by reducing the train movements, averaging from 4 to 15 down to 2. This was achieved by the use of 93 motor cars. Up to the present trains of these cars are only running on one division, but this will shortly be increased. It is found due to the higher rate of acceleration possible that these trains can be more quickly despatched and have permitted reducing running time considerably. Each car has 2/225 h.p. motors, and an eight-car train is found to draw [illegible] h.p. when accelerating. The fluctuation in power demanded [illegible] varies from [illegible],000 h.p. to zero, averaging 8,000 h.p. per hour during the rush period. The [illegible] demanded by this service is therefore not only considerable, but very fluctuating. Power service is purchased from the Philadelphia Electric Company.

Butte, Anaconda, and Pacific Railway.

The Butte, Anaconda and Pacific Railway, which began electrical operation in 1913, is in many ways one of the most remarkable examples of electric train haulage in this country. While previous examples of steam road electrification have been equipped for various reasons, either tunnel and terminal operation or for high speed suburban service, this road was electrified purely for reasons of economy. The results of this changeover have amply justified the initial cost of the electrification, a comparison of operating results during the first six months of electrification showing a saving of an amount equal to 20 per cent. of the initial cost, not allowing any salvage for steam engines released.

The electrified tracks of this company consist of 30 miles of route between the mines at Butte and the smelters at Anaconda and about 114 miles on a single track basis. Power is purchased from the Montana Power Company's extensive system at 2,300 volts, 60 cycles, and is transformed by motor generator sets to 2,400 volts direct current for use on the trolley. There are two substations, one located at Butte and the other at Anaconda, both of these being installed in the existing transformer stations of the power company. The initial rolling stock included 15 freight and 2 passenger locomotives, and 8 additional locomotives have since been purchased to take care of the heavy increase in traffic.

The freight traffic consists largely of transfer of copper ore, and at present amounts to more than 6,000,000 tons per year. This material is handled in steel ore cars, having a capacity of about 50 tons each. The weight of train hauled over the main line, including a .3 per cent. grade, frequently reaches 5,000 tons trailing.

Eight passenger trains per day are operated between Butte and Anaconda, each consisting of from three to five passenger and baggage cars.

The overhead construction on this system is made especially flexible by the use of loop hangers, which allow the contact wire to rise without lifting the weight of the messenger. There also may be other novel features in the switching yards and at street railway crossings.

The eminently successful operation of this initial 2,400-volt railway was largely influential in the decision of the Chicago, Milwaukee and St. Paul Railway to electrify its mountain divisions at 3,000 volts direct current.

Chicago, Milwaukee and St. Paul Railway Transcontinental Electrification.

The Chicago, Milwaukee and St. Paul electrification differs from all previous projects of this kind, in that the transcontinental lines involved embrace four complete engine divisions as operated by steam locomotives. None of the existing electrifications on trunk line railways, either in this country or in Europe, have included more than one engine division. For this reason there has been no opportunity for interchange of spare locomotives and no possibility of materially reducing the number of spare steam locomotives required for the operation of the system.

The Missoula and Rocky Mountain Divisions of the Chicago, Milwaukee and St. Paul Railway include 440 miles of route, embracing approximately 650 miles of single track lying between Harlowton, Montana, on the east, and Avery, Idaho, on the west. This road is one of the main transcontinental highways of the country, and the divisions being electrified contain the most serious grades encountered on the Chicago, Milwaukee and St. Paul Railway between Chicago and the coast. Under steam operation these four divisions required 103 steam locomotives of the heaviest types, and even with this number of engines the schedule was maintained with difficulty. In the winter, when temperatures range as low as

40 to 50 degrees below zero, it is extremely difficult to keep steam locomotives in operation. It is no uncommon occurrence to find several locomotives stalled during cold weather, with fires drawn and water removed from the boiler, owing to the freezing of some of the piping which is exposed to the weather. Furthermore, it has been found that after hauling a train over a 112-mile division for about three days in succession it is necessary to put the locomotive into the shops for a day's overhauling.

The electrical equipment for this electrification includes 42 main line passenger and freight locomotives and two switchers, and experience with electric locomotives on the first two divisions seems to indicate that these locomotives will be amply sufficient to take care of the present traffic and normal increase within the next few years. In addition, it is probable that trains will be operated much more nearly on schedule time and with less damage to equipment owing to accidents. In the operation of the first division it has been found that one electric is capable of easily replacing three steam engines, and possibly four, when other divisions are put in operation. The reasons for the much greater capacity of the electric locomotives per unit are: First, ability to operate a large per cent. of the 24 hours with minor inspections; and, second, ability to haul equivalent trains at approximately double the speed of the steam locomotives. Many other advantages may be mentioned which tend to increase the capability of the electric locomotive as compared with the steam. Not the least of these is the regenerative braking feature, which relieves the brakes of a large portion of the wear and heating due to holding heavy trains on severe grades.

The 440 miles of route involved in this electrification will be fed from fourteen substations, located at points averaging 33 miles apart, each station receiving power from the Montana Power Company's system at 100,000 volts and transforming to 2,300 volts for synchronous motor generator sets. These sets are of the three unit type, consisting of a synchronous motor and two 1,500-volt d.c. generators connected permanently in series to deliver 3,000 volts to the trolley. Each station contains either two or three of these sets, there being a total of 32 sets in the 14 substations. Two small generators, one on each end of the set, furnish exciting current for the main fields of the generators and for the revolving field of the motor. The substation equipment is so arranged that in case the regenerated power sent back by the locomotives exceeds that being used nearby the motor generator sets will operate inverted, and thus return excess energy to the transmission system and thence to other substations requiring power. Measuring instruments are arranged to credit the amount of this returned energy to the railway company. Each of the substations is in charge of three operators, working on eight-hour shifts, and these men are at all times under the direction of the train and power despatcher, who gives instructions for the operation of the station. Two model bungalows have been built by the railway company at each station for housing the operators.

As above mentioned, electric power is received at 100,000 volts, 60 cycles, from the transmission network of the Montana Power Company, operating numerous hydro-electric plants in various parts of the state.

The largest of these stations are located at Great Falls and at Thompson's Falls. In order to insure power supply at all times there are several feeding-in plants, and the railway company maintains a separate 100,000-volt transmission line the entire length of the electrification.

One of the most completely equipped hydro-electric plants on this system is the Volta plant, in the Great Falls of the Missouri River. This station at present contains four 100,000 kw. vertical generators and two additional units are being installed. The available head at this point in the Missouri River is 155 feet, and the supply of water at all times is ample.

The main line locomotives, a number of which are now in service, have a total weight of 282 tons, with 224 tons on the driving axles. The cab consists of two similar sections, extending practically the full length of the locomotive. The freight and passenger locomotives are similar in all respects, except that passenger locomotives are provided with a gear ratio permitting the operation of 800-ton trailing trains at approximately 60 m.p.h., and are furthermore equipped with oil-fired steam boilers for heating the trailing cars. Each locomotive carries eight 430 h.p. motors each geared to a driving axle with twin gears. These motors are designed to operate at 1,500 volts per commutator, two motors being permanently connected in series across the 3,000-volt circuit. The tractive effort available for starting trains is approximately 135,000 pounds at 30 per cent. co-efficient of adhesion, and the continuous tractive effort of the freight locomotives is 71,000 pounds. In addition to the eight driving axles, each half of the locomotive carries a two-axle guiding truck, which supports approximately 30 tons weight. The motors are ventilated by a forced draft from a blower, which is driven from the control motor generator set located in the cab of the locomotive.

One of the most distinctive features of this electrification is the regenerative braking on the locomotives, which permits the return of energy to the system on descending grades instead of checking the speed of the train by means of the air brakes. The amount of braking is directly under the control of the engineer, and the air brakes are relieved of practically all service except when bringing the train to a final stop. It should be understood that when braking a train by the regenerative method there is no overheating, as in the case with air brakes, and consequently there is a material reduction in the wear on brake shoes, tires, and rails. In addition to this, the air brakes will always be in good condition when required for emergency service, and delays due to excessive wear will be greatly reduced. In actual practice it has been found that a large portion of the power regenerated by trains on descending grades is used up by other trains taking power on the level or ascending grades. In some cases when there is no train available for absorbing the excess energy the power is taken up by one or more substances and returned to the transmission system connecting the several substations.

During the early part of December, 1915, an interesting comparative exhibition was staged by the Chicago, Milwaukee and St. Paul Railway for the purpose of showing prominent officials the comparative capabilities of steam and electric locomotives. The observation party was stationed at Janney Substation, on the western slope of the Rocky Mountains, and about midway on the 1.66 per cent. ascending grade. The first train sent up the hill was hauled by one of the 282-ton electric locomotives, assisted by a similar unit acting as a pusher. The train consisted of 48 cars, weighing approximately 3,000 tons trailing, and negotiated the grade very easily at about 16 miles per hour. Following this was a second train, hauled by two Mikado type steam locomotives and one Mallet steam pusher. The steam train consisted of 37 cars, weighing about 2,200 tons, and difficulty was encountered in making the grade at a speed of from 9 to 10 miles per hour. Upon completion of the test President Earling indicated his entire approval of the electrical equipment, and gave instructions for putting it into regular service immediately.

It may be safely concluded that there are important economical and expedient reasons why the number of electrifications will continue to increase rapidly, and especially in our own country, with its numerous waterpowers, the ever-increasing cost of coal, and growth of population.

The town of Greenfield Park, P.Q., on the south shore, opposite Montreal, propose to install a system of electric lighting, and are selling $25,000 bonds for this purpose.

The Dealer and Contractor

A New Slogan for the Electrical Contractor—Stumbling Blocks in the Industry—Organization Means Results and It's Results We Are All After.

The subject I am requested to bring before you is that new preparedness slogan that seems to be in the air—25-20—forgetting the original slogan of 15-25. It is with great pleasure that I accept the request, for this 15-20—or, rather, 25-20—preparedness movement is a pet hobby of mine. The reason may be that I need it more than some of my competitors; but, nevertheless, it is conceded that a number of electrical contractors in San Francisco and Oakland are following the new slogan.

Now, gentlemen, don't misconstrue what I say, and think that some of us get together and agree that 25-20 should be the per cent. added to our cost. Such is not the case. It is merely the idea of George Sittman, and practised by him. Capps Kinney, who likes a dollar as well as any of us, says: "It's a good thing, and I am going to follow it." Butte, Reid, Fortini, and all the rest of them, not being overburdened with a million or more to their credit in the bank, are all of the same opinion. The first thing you know when you make up your estimate on a job it'll be second nature with you to add 25 per cent. overhead to your bid and 20 per cent. profit.

This may look unreasonable to some, and say it can't be done; that it is a hold-up game, and all the like of that. I disagree with anyone who says this, and I will challenge anyone who tells me that it is too great a percentage to add in our business.

Have you ever looked into the general contractor's game as far as his overhead is concerned? Isn't it true the general contractor makes you and the other crafts carry practically all his overhead on a job? All he does is to take the figures and make up his bid. All he has invested is in the rental of some office. He might also have a bookkeeper to take care of his books. Now, that man's overhead is not one-half of yours, and as the amount of money he turns over is considerably larger, he can easily be satisfied with the smaller percentage, especially as you carry part of his overhead, the plumber carries another part, and so on down the line. There might be some exceptions to the above statement, but they are very few. Overhead in the electrical contracting game has never been seriously taken into consideration by any contractor in this section, and it is a crime to see large jobs go with about 5 or 10 per cent added to the cost. Still, it wouldn't be so bad if the cost figured would be the true cost, but as a rule there are so many items forgotten—for instance, the cost of bond, liability, interest on money borrowed, inspection, etc. That by the time the job is completed you are another step nearer business suicide.

I am convinced that 25 per cent. overhead and 20 per cent. profit are absolutely essential in our business. A business that has so many angles and details attached to it that requires such a large amount of attention as ours, cannot be successfully handled unless 25-20 per cent. is added to each job. Think for a minute. Call to your mind any fair-sized job. Your overhead began when you figured the job, and kept on running until the job was accepted, and then some. In nearly all cases the electrical man is first and last on the job. Now take that same job completed, with 5 or 10 per cent. added to your cost, and sum up for yourself. Be honest with yourself. You will find that you lost money. If you are doing your own estimating and other work at your place of business, for which you would have to pay dearly, it is not only right, but it is proper to add this to your cost. Never think that the hundred or two hundred dollars that you may pay yourself represents profit. It is nothing else than overhead, and should be considered as such. We hear so many small electrical contractors say that they have no overhead. They will tell you that they have their place of business in their own home; they have no rent, no bookkeeper or stenographer; that their wives are taking care of those features, and they have no estimators or superintendents, etc. Now, don't you honestly believe that the electrical contractor who tells you all this is fooling himself and just kidding himself along It is just this type of men who are hard to convince about associations. They are the stumbling block to the success of the industry and dangerous to our business.

Queering the Business.

There is a great amount of business that men of such caliber queer and, instead of their joining their craft association, so they may be taught how to figure overhead and profit, they stay on the outside and keep on demoralizing the business. There seems to be only one way of convincing such people that they should join the association, and that is through the efforts of the architects and general contractors. We have outgrown our short pants, and are ready to wear men's clothes, and you can all rest assured that there will be no going backward. San Francisco has an electrical contractors' association that intends to do things and do them right. San Francisco contractors are enthusiastic over this preparedness slogan, and there isn't the slightest doubt in my mind they will never go back to the old, demoralized condition. Now, what brought about all this enthusiasm? Nothing else but confidence in one another and knowing how to figure correctly.

It has been demonnstrated of late that it can be done, and if there are any "doubting Thomases" in this hall to-night I will try to convince them they must get 25-20 if they want to be successful business men. Why shouldn't the electrical contractors become independent, the same as other business men? I say that they should. But have they in the past? They have not. Take some of our craft. Don't you think it is a pity to see them back working for someone in their old days, when they should have enough of the earthly blessings to take it easy for the rest of their lives? What does the average electrical contractor contribute towards the security of his family? Nothing. He cannot even afford to educate his children properly.

Now, brother contractors, have you ever thought of the

Speech delivered before the California Association of Electrical Contractors, [illegible] game from the standpoint just mentioned. I think not. I think it is about time for all of us to try and make some money in our business. The past ought to be a lesson to all of us, and we certainly should have learned from past experience that we must do something to better our social and financial condition. There is only one way of doing this. We must work together and have confidence in each other. On figuring jobs add the proper percentage. Associations cannot be built up in a day, for if they spring up like a mushroom they will die the death of one. San Francisco can be proud of its association of electrical contractors and dealers, and the San Francisco local even now would not be successful if it were a one-man affair. But all its members deserve credit. They are all workers, and, what further counts, they work in harmony. **It is not necessary for me to explain what it means when a whole body works as a unit. Where there is a unit there is organization. Where there is organization there is action. Where there is action there must be results. Now, results are what we are all after.** Those that are not affiliated with an organization cannot hope for results.

In closing my remarks, I again would like to impress upon all contractors here assembled that they should forget little old-time grievances. Be square with yourself and you cannot be any other way with your competitor. See your competitor, talk with him, have lunch with him once in a while, and it will not be long before results will show up, not only in your business but also in your competitor's.

Finally, I would like to suggest to those contractors who are still on the fence that they should get into the association with us; work with us, and I am positive if they do this they will gradually become good working members and be a credit, not only to the association, but to the electrical industry.

Toronto Electrical Inspection Notice

The Electrical Inspection Department of the city of Toronto has sent out letters to manufacturing establishments and the owners of large buildings, chiefly where the owners have their electrical work attended to by their own men, calling attention to the regulation contained in the Power Commission Act requiring a permit in writing before any alterations or additions are made to the wiring. The letter points out, however, that since a strict interpretation of this rule might work hardship in certain cases, a special arrangement is being offered whereby an annual fee is paid which entitles the owner to regular monthly inspection—this inspection to be made whether any work has been done or not. This arrangement will, no doubt, be taken advantage of by many of the larger establishments throughout the city. The letter reads as follows:—

Electrical Inspection Department,
District of Toronto
December 20th, 1916.

Gentlemen:—

We desire to draw your attention to the provisions of the Power Commission Act which requires that all firms, individuals or others apply to the Electrical Inspection Department and obtain a permit in writing before in any way altering or adding to any existing electrical installation or installing new wiring; also violation of this regulation is punishable by law.

In manufacturing establishments and other large buildings where the owners employ engineers or local electricians to attend to their electrical repairs, alterations or additions, this rule might become a hardship, as under a strict interpretation thereof they would be obliged to take out a permit for every change or addition. In order to overcome this difficulty, a special arrangement is being offered, whereby an annual inspection fee can be paid, entitling the owner of the premises to a regular monthly inspection. These annual inspection fees are based on the number of employees in the case of factories, and in other buildings will be commensurate with the amount of work likely involved. The minimum annual fee for this service is $10. That will be in a factory where not over one hundred employees are engaged.

We will be glad to discuss this question with your firm at your convenience, and will endeavor to have one of our inspectors call on you in the near future; but, in the meantime, if you decide to enter into this arrangement it may be started any time by calling at the Electrical Inspection Department Office, 201 Temple Building, Toronto.

This arrangement has already been adopted by a large number of manufacturers and has been highly commended, and even if there was no work done at all during the month, the inspector would nevertheless go over the installation and report any inherent defects which might develop, and draw the attention of the management or owner to any danger created thereby.

If you desire further particulars regarding this matter full information and advice will be given upon application to the undersigned.

(Signed) A. G. Hall,
District Inspector.

Cornwall Awards Contract for Motor Driven Pumps

The Turbine Equipment Company have obtained a contract from the town of Cornwall to supply and install two 10 in. De Laval single-stage pumps, each of which will have a capacity of three and a half million gallons a day against 180 ft. head when operating individually; seven million gallons a day against 180 ft. head when operating in parallel, and four and a half million gallons a day against 310 ft. head when connected up in series. This installation is somewhat unique, inasmuch as the pumps will be driven by hydraulic turbines; these will be supplied by the William Kennedy Company, of Owen Sound. The speed of these turbines will be 200 r.p.m., and to enable a speed of 1,650 r.p.m. being attained on the pumps a set of De Laval double helical reduction gears will be installed between each turbine and pump.

Courtesy "National Electrical Contractor"

The well "Done" Electrical Contractor.

Wire Sizes for Electric Ranges

The Boston Edison Company have issued a card schedule showing sizes of wires to be used for connecting up electric ranges, the schedule including capacities from 1 to 20 kilowatts. The directions for using the table are, first, to determine the total load in kilowatts and, if this is an odd value, use the next higher. Next measure the length of the run from the service entrance switch to the load, find this figure on a table opposite the given load, and the head of this column represents the smallest size of wire allowable. This table will be found very useful by contractors installing electric ranges. A copy of this schedule is reproduced below:

Load in kw.	No. 14	No. 12	No. 10	No. 8	No. 6	No. 4	No. 2
1.0	191	304	484	770	1220	1940	3100
1.5	127	203	322	513	815	1290	2060
2.0	95	152	242	385	610	970	1550
2.5	76	121	193	308	488	775	1240
3.0	63	101	161	256	406	647	1030
3.5		87	138	220	349	555	886
4.0		76	121	192	305	485	775
4.5			107	171	271	431	690
5.0			96	154	244	388	620
5.5			88	140	222	352	564
6.0				128	203	323	517
6.5				118	188	298	477
7.0				110	174	277	443
7.5				102	163	258	414
8.0					152	242	388
8.5					143	228	365
9.0					135	215	344
9.5					128	204	326
10.0					122	194	310
10.5					116	185	295
11.0					111	176	282
11.5						168	270
12.0						161	258
12.5						155	248
13.0						149	239
13.5						143	230
14.0						138	221
14.5						133	214
15.0						129	206
15.5							200
16.0							194
16.5							188
17.0							182
17.5							177
18.0							172
18.5							167
19.0							163.
19.5							159
20.0							155

DIRECTIONS

1. Find total load in kw.
2. If odd value, use next higher.
3. Measure actual distance in feet along run from load to service entrance switch.
4. Opposite load from table find smallest size wire allowable for that distance.

EXAMPLE

5 kilowatts, 100 feet
Opposite 5 kw. find distance next larger, it being in this case 154. At head of this column note wire size. The result is No. 8.

Toronto Electrical Contractors Dine

On Wednesday evening, December 13th, the electrical contractors of Toronto held their second fortnightly dinner at the Hotel Carls-Rite. The guests of the evening were Captain Matheson and Lieutenant Armer, of the Canadian Engineers. Capt. Matheson, who went over to France with the Second Field Company, First Canadian Divisional Engineers, has seen service in the trenches for about eighteen months. Last year the captain was awarded the military cross for outstanding work in the battles of Ypres, Festubert, and Givinchy. Having been wounded, he is now in Canada on sick leave, and is lecturing the various battalions of this military district on the subject of trench warfare. After having heard in the past two years so many accounts of this trench warfare in general terms it was enlightening to hear a definite description, in concrete terms by a man who has had charge of the actual construction and maintenance of the front line trenches. One realizes just how necessary it is for the preservation of man power that each particular piece of work not only be done, but done in the time allotted. Those present had their views entirely changed also as to the importance of the engineer private, known as a sapper. Briefly, his position at the front—that of a foreman or superintendent of construction, the men who actually do the work, being assigned to him from other units. At the close of this talk the captain invited questions, thus affording an unusual opportunity.

The meeting was brought to a close with cheers for the captain and lieutenant, and with a feeling amongst all of a deeper sense of the problem before the empire. This gathering was typical of that desired by the committee, the object being to get the contractors together on things above those merely commercial. The next meeting is at the Carls-Rite, Wednesday, January 3rd, at the usual hour.

B. C. Association

Electrical Contractors and Dealers

DINNER

Thursday, October 26, 1916
Chairman:—C. H. E. Williams
7.45 to 8 p.m. Introductions round the table
During Dinner
The B. C. Electric String Quartette Will Play

MENU

Hors d'oeuvre D'association electrique
Soupe, a la Soldering Paste
Fish Insulate
Entree pour le Fuse Plug
Roast Canard, 25% and 20%
Savoury avec le pip
Cafe, a la B. C. Electrique
Cigars for all

God Save the King

Great West Electric Co., Ltd.

The Mainer Electric Company, Limited, of Winnipeg, have changed their name to "Great West Electric Company, Limited." The officers, directors and shareholders of the new company remain the same. The firm now occupy the entire ground floor of Hammond Block, using the additional space for offices and with the increased space for warerooms and shipping department, are now in a position to render greater co-operation with the trade and more prompt service in handling orders. The company advise that this change has been necessitated by their rapidly growing list of customers.

Sherardized Coins

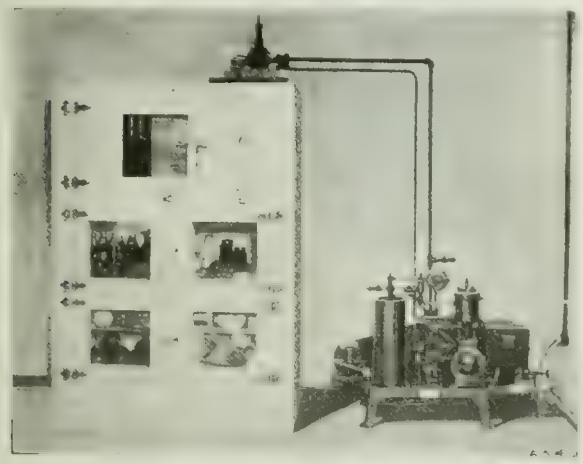
The National Metal Molding Company are issuing a card in which they point out that the latest German coins are made of sherardized iron, and from this draw the conclusion that this process of protecting iron from rust is at the same time efficacious and economical. The card further points out that there is but one sherardized conduit—Sherarduct the product of this company.

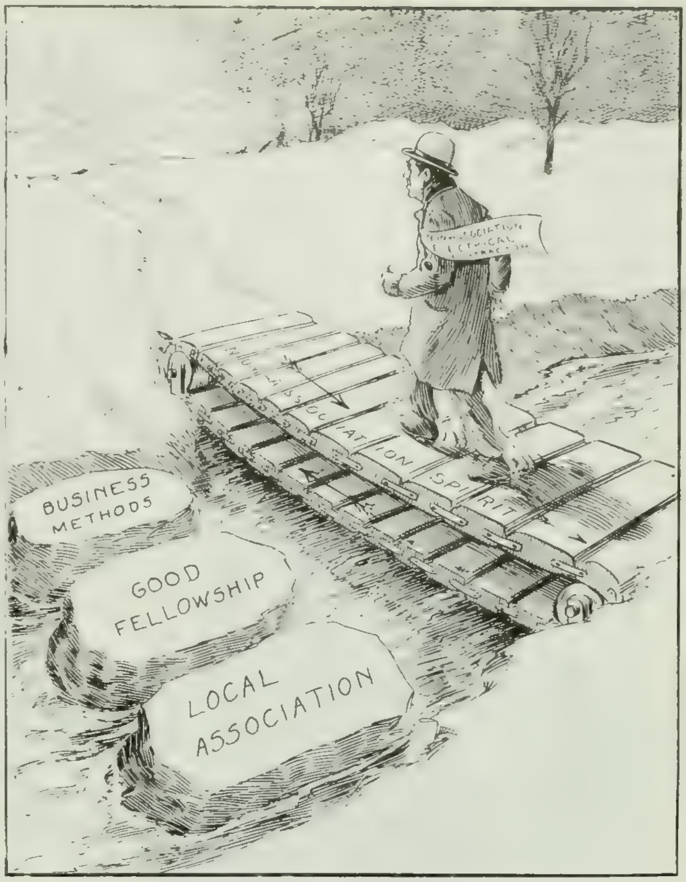
Hessco Company Resumes Operations

The Hessco Company, 210-214 Adelaide Street West, Toronto, manufacturers of Hessco electrical supplies, will again resume active operations early in the new year. The company have been successful in obtaining large quantities of raw materials, which will enable them to carry on the manufacture of their products in a more extensive way. Further announcements will be made at a later date.

World's Wonder Ice Machine

Summer or winter, nothing is more important than the economical and efficient refrigeration of food stuffs, whether for home, hotel, restaurant or store. While food may be kept cool by means of ice, it is impossible to maintain the ice box at a temperature sufficiently low to keep the food in perfect condition. To be perfectly kept, food stuffs should be stored in a dry temperature uniformly maintained at about 40 degrees. This temperature cannot be maintained with ice, as the melting of the ice lessens the amount in the box and a slow rise in temperature occurs, resulting in spoilage of the food stored therein. Another objection to ice is its uncleanness, sediment being deposited in the ice box as the ice melts, permitting germs to mingle with the food. These objections have long been recognized and the ideal method sought would embody the principles of cleanliness, uniformity of temperature and avoidance of waste by spoilage. Modern electric refrigeration includes these three principles. It is exemplified by the McClellan System of refrigeration, which consists of a specially designed, small, compact, high efficiency refrigerating machine driven by an electric motor which circulates ammonia through cooling coils. The coils are located in the ice chamber of the refrigerator and connected to the refrigerating machine by piping. The refrigerating machines are made in five sizes. All are driven by Westinghouse motors. The sizes run from 1/15 ton machine, the equivalent of melting 133 lbs. of ice per 24 hours, to a one-ton machine the equivalent of melting 2,000 lbs. of ice in 24 hours. This system is adapted to all conditions and can be attached to any ice box, making ideal refrigeration possible for homes, markets, stores, restaurants, hotels, hospitals and clubs. There is no moisture as with ice. The moisture and odors thrown off by the food are taken up, condensed and frozen to the brine tank or pipe coils, keeping the air dry. The result is a uniformly dry temperature, an entire elimination of all germs thrown off by the food, as well as prevention of germ development. In other words, sanitary and hygienic refrigeration is obtained, which keeps products as long as it is desired to keep them, without spoilage and consequent waste.



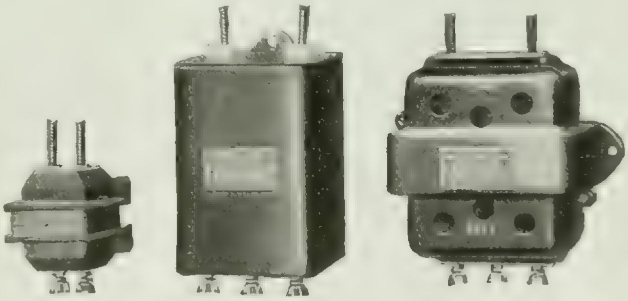


—Courtesy National Electrical Contractor

Many electrical contractors mistake a treadmill for a bridge—These are advised to try the stepping-stones.

Wayne Bell Ringing Transformers

The use of bell ringing transformers in the place of batteries for operating electric bells, annunciators, thermostats, door openers and other similar devices which can be operated by alternating current is rapidly becoming recognized as advantageous. Batteries for this purpose are neither as satisfactory nor as economical as bell ringing transformers, since they require renewal, cause annoyance when renewal is necessary and in time cost more than the bell ringing transformer, which, once installed, will last indefinitely and requires no further attention. When designing a building, architects should, to correctly incorporate this feature, include in their specifications a bell ringing transformer, and specify alternating current bells, electric door openers and annunciators, since such devices, properly selected and installed, add to the convenience and attractiveness of the building. Wayne bell ringing transformers, sold by the Canadian General Electric Company, are made in capacities suitable to every bell ringing requirement between the ranges of 10 and 125 watts capacity inclusive. They are classified as follows: Small transformer with single secondary voltage; medium capacity transformer with three secondary voltages; large capacity transformer with three secondary voltages. In manufacturing these transformers the highest quality of materials and workmanship is employed. The coils are independently wound and designed to withstand a 2500 volt insulation test between primary and secondary, and primary and ground, also a 1,000 volt test between secondary and ground. Primary leads are adequately extended for attaching to the lighting circuit. Connections to the secondary circuits are made by substantial thumb nuts and studs

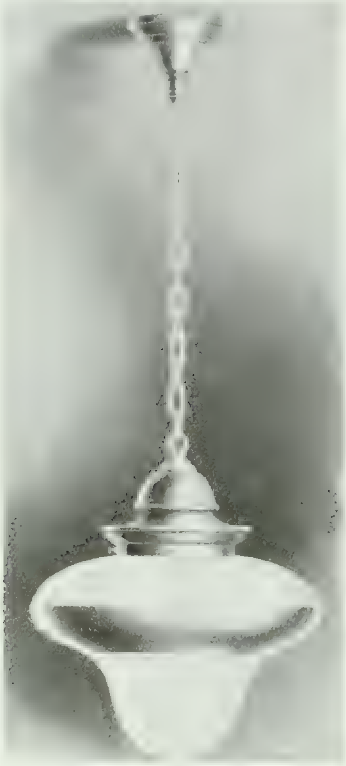


which provide a ready means for attaching one or several bell circuits. The core and coils are encased and sealed in attractive black enamel cast iron cases and tamper-proof. The Wayne transformer presents a good appearance wherever installed.

Ajax-o-Lite for Commercial Lighting

The steadily increasing appreciation of the value of correct lighting for commercial buildings has resulted in the manufacture of a great variety of lighting equipment. A popular lighting fixture is the two-piece unit, consisting of a reflector above, with a diffusing bowl below. In many of these types there is a gap between the bowl and reflector, which allows the dust to collect, and it is often necessary to dissemble the entire fixture to clean it.

It was in an endeavor to overcome these defects and at the same time utilize practically the same principle that the Ajax-o-Lite illustrated herewith was designed by the MacBeth-Evans Glass Company. The glassware used is total-enclosing, enameled top and bottom, with a clear band separating them, as shown. The upper part acts as a reflector and the lower part as a diffusing medium, at the same time concealing the lamp. High efficiency of the unit is due to the shape of the glassware, the idea being to have the greater part of the light reflected through the clear band, thus reducing the absorption of light to a minimum. The fact that the glassware is totally enclosing prevents the accumulation of dust. The fixtures can be furnished in any finish, and the glassware can be furnished in three sizes—12 in. diameter, with 5 in. fitter; 15 in. diameter, with 6 in. fitter (as illustrated); and 17 in. diameter, with 8 in. fitter.

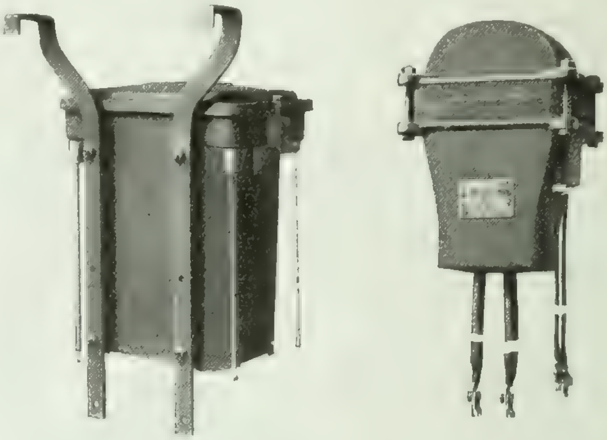


Dalyte Lamp Co.

The Dalyte Lamp Company, Limited, has been incorporated at Guelph, Ont., with a capital of $200,000. Parties interested in the new company are J. E. Carter and J. S. Wheeler. The new company will manufacture lamps and general electrical supplies.

Safety Coils for Series Alternating Current Circuits

For use where the voltage of series arc or incandescent alternating current circuits is too high to permit the safe installation of lamps, the Westinghouse Electric & Manufacturing Company have developed the safety coils illustrated. These coils are for indoor and outdoor service and are especially useful on installations where a series lighting system is desirable but high voltages are impracticable; as for instance, on streets with numerous trees where to run the main series circuit would result in trouble from ground; on bridges and in subways where the high voltage of the regular series circuit is prohibitive, or for lighting fire-alarm, police, and letter boxes, where high voltagegs so near the ground would prove dangerous. They are also invaluable where but a few lamps are required in a building and a multiple circuit is not available. The coils are essentially one-to-one ratio series transformers insulated for high potentials, being tested for 20,000 volts for one minute between windings and between windings and iron. The smaller capacities of these coils are built for air cooling, and are of the same form of construction as the standard Westinghouse dry type current transformers. The magnetic circuit, having laminations exposed to the air, is clamped between cast-iron end caps which protect the windings, the leads extending downward through suitable bushings in the bottom end-cap. The coils are impregnated with an insulating compound which thoroughly seals up the joints between the laminations and the end-caps. The larger capacities are oil insulated and are of the same form of construction as the oil-insulated distributing transformers made by the same company. When installed, the primary of the coil is connected in the regular series circuit, the secondary then supplying the lower potential series circuit. Regular series lighting fixtures should be used. The necessary oil and hanger irons for pole mounting are furnished with the oil-insulated coils.



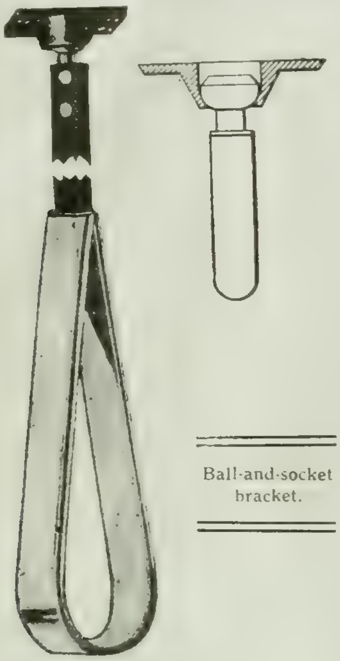
Statue of Liberty Flood Lighting

The most recent example of flood lighting in the United States is of their Statue of Liberty, Bedloe Island, in which 15 batteries of projectors—246 in all, of 250 watts capacity each—have been installed. The lamps are 35-volt type, supplied through individual compensators from a 220-volt current supply. The lamp, held at arm's length by Miss Liberty, consists of about 15-500 candlepower gas-filled units, operated by a series of flashers, to simulate the quiver of a flaming torch.

The Turbine Equipment Company have been awarded a contract for centrifugal sewage pumps for the town of New Toronto. Two of these will be driven by vertical motors and the other will be direct connected to a high-speed gasoline engine.

Ball-and-Socket Hand Strap Bracket

The "ball and-socket" hand strap bracket shown was devised by a railway master mechanic to eliminate hand strap breakage, and is described in Electric Traction. Several passengers had been injured through such breakage, and the courts had awarded considerable damages for injuries caused in this way. Examination of the broken straps disclosed the fact that they were not pulled apart, but were twisted off, and straps still in service showed signs of weakness at the point where they were attached to the stationary bracket.



Ball-and-socket bracket.

With the hand strap attached to the bracket, shown in the accompanying cuts, the ball and socket takes all the wear, eliminating the twist in the strap and providing a straight pull at all times. These brackets may be attached to horizontal or perpendicular surfaces or to a pole, and straps that have been broken where attached to a stationary bracket can be trimmed off and attached to the long ball tongue.

Installing Service Under Pavements

Considerable expense has been saved by a large Eastern electric service company when conduits have to be installed under pavements, sidewalks or railroad tracks by using a pipe-forcing jack. By employing this apparatus the company has also avoided disturbing lawns and flower beds, removing and replacing patent sidewalks and pavements and obstructing traffic by ditches.

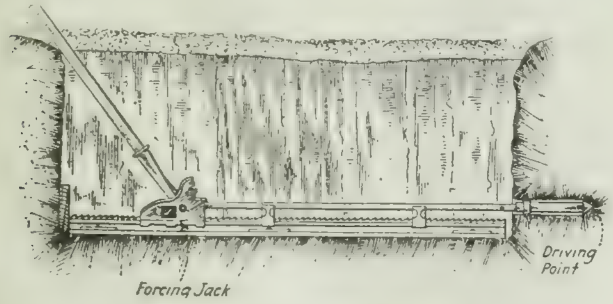


Diagram showing installation plan.

The jack is constructed of malleable iron and steel and consists of a cage, which travels on a rack, being moved by a socket lever and pawls. At the front of the cage is a groove and clamp for holding pipe ranging from 0.75 in. to 4 in. in diameter. The rack has machine-cut teeth, is provided with bolts for bolting to a plank, and carries two guides for holding the pipe in line.

To use the jack it is placed in a ditch as shown herewith, the conduit set in the position, and the front end provided with a pointed steel nose, which will cut its way through the earth. The steel nose is attached by a standard coupling. The pipe is then forced through the earth by common laborers. When the cage reaches the limit of its travel, it is drawn back to its starting point and a new section of pipe placed in position and fastened to the first section. The operation is repeated until the desired length of pipe is installed.—Electrical World.

Push Type Socket

The illustration herewith represents the new Cutler-Hammer push socket which the Benjamin Electric Company of Canada have recently placed on the Canadian market. These sockets are all of 660 watt capacity, tested, rated, and approved by the National Board of Fire Underwriters. They are designed to meet many of the objections of the chain or snap type. An insulating bushing is provided in the cap large enough to allow reinforced cord to pass through easily, and there is also a patented, approved cord-strain relief, which makes it unnecessary for the wireman to tie a knot in the cord. This socket is suitable for installation in any position.

New C-H push socket.

Trade Publications

O-B Bulletin—September-October issue of the O-B Bulletin, issued by the Ohio Brass Company, Mansfield, Ohio; an interesting booklet published by this company every other month, describing electric railway and power transmission equipment.

Wiring Devices—catalogue No. 24, by Pass & Seymour, Inc., Solvay, N.Y., describing their "Handy Electric Wiring Devices." This catalogue is illustrated very completely, each illustration being accompanied by descriptive matter and information as to price, weight, standard package, and so on.

Storage Batteries—The Canadian Hart Accumulator Co., Limited, St. Johns, Que., are distributing their 1917 catalogue of the "M.S.L." battery for automobile starting and lighting service. This catalogue is illustrated and contains several useful tables of the different sizes, capacities and prices of batteries manufactured.

Meters and Relays—Among the publications recently issued by the Westinghouse Electric & Manufacturing Company are a series of leaflets covering meters and relays of various types, including d.c. meters of small diameter for use on automobiles, portable voltmeters and ammeters for testing purposes, and types CO overload and CR reverse power a.c. relays. These instruments are illustrated and described in leaflets 3949, 3950, and 3814 respectively.

Current News and Notes

Bala, Ont.

The Bala Electric Light and Power Company, Limited, Bala, Ont., has been incorporated to generate and supply power in the village of Bala, and vicinity. Capital $25,000.

Gravenhurst, Ont.

A meeting was held at Gravenhurst, Ont., recently to discuss the possibility of an electric railway from Baysville to Gravenhurst to connect with the G. T. R., and a committee was formed to initiate negotiations with the Ontario Government for financial assistance. Local sentiment is strongly in favor of the project.

Hamilton, Ont.

The Tallman Brass Company, Hamilton, Ont., are adding a $50,000 addition to their factory.

Kitchener, Ont.

The Light Commissioners of Kitchener, Ont., will purchase three 500 kw. transformers to supplement the present equipment, which is inadequate to meet the existing demand.

The present demand for Hydro power at Kitchener, Ont., is 3,200 h.p. and it is anticipated the demand will reach 4,000 h.p. in a few months. This is an increase from 700 h.p., which was the load at the beginning.

London, Ont.

In the presentation of the annual report of the London, Ont., public utilities commission, it was shown that in spite of a reduction of 12 per cent. in rates and generous contributions to patriotic funds, the surplus amounted to $68,500, or $8,000 more than last year. The consumption of current in private homes has increased 25 per cent. during the year and the increase in number of consumers is given as 1,023, making the total 9,723. The "hydro shop" reports the sale of 225 electric ranges and about 1,000 electric irons. It is anticipated that a further rate reduction of 5 per cent. will be made during the coming year.

The Public Utilities Commission, London, Ont., have awarded a contract for the supply of electrical transformers for the local Hydro-electric system, to the Packard Electric Company, St. Catharines.

Montreal, Que.

A series of co-operative sessions of the employees at the Cedars Rapids plant, P. Q., has been arranged. These take the form of suppers, followed by speeches and discussions of various points relating to the operation of the plant and similar subjects. At the last session, Mr. R. M. Wilson, the chief operating engineer, was the principal speaker, giving a resume of the progress of this plant as well as of the Montreal Light, Heat and Power Company.

The Southern Canada Power Company, Limited, have removed from 43 St. Francois Xavier Street to 330 Coristine Building, Montreal.

A bill introduced by Mr. Perrault, relating to telegraph and telephone companies, has been given a third reading in the Quebec Legislature. Under the present law three or more persons organizing a company must make out a certificate stating all the places to which they wish to run, their capital, and other particulars. No provision is made for a company, after being organized and commencing work, to extend their lines beyond the points stated in the original certificate. Mr. Perrault's bill remedies this by allowing the secretary of the company to file a statement before a notary giving particulars of the proposed new routes. This will have to be sent to the Provincial Secretary.

Nelson, B.C.

The fire, water and light committee of Nelson, B. C., have recommended to the city council the installation of a third unit at the local power plant to cope with increasing demand and to anticipate any possible breakdown of the present plant.

The new 10,000 h.p. unit installed at the Bonnington Falls (Nelson) plant of the West Kootenay Power and Light Company, Ltd., is now in daily use as part of the 40,000 h.p. capacity of that plant. The new unit was made necessary by the development of smelting and mining operations in Kootenay and Boundary districts.

Pembroke, Ont.

Plans are in progress for a $7,000 power house for the Pembroke Electric Light Company, Pembroke, Ont. Tenders will be called for a 1,250 kw. generator, three transformers, water wheels, shafting, etc.

Peterboro, Ont.

Alexander and Miller, electrical supply dealers, Peterboro, Ont., recently suffered loss by fire.

Port Arthur, Ont.

A by-law will be submitted at the January elections at Port Arthur, Ont., to decide whether or not the Hydro-electric Commission of Ontario shall be authorized to construct a plant at Dog Lake for the supply of some 30,000 h.p. Power is at present secured partly from Current River and from the plant of the Kaministiquia Power Company.

Simcoe, Ont.

Twenty-two farmers in the townships of Windham and Townsend, near Simcoe, Ont., have decided to petition for an extension of Hydro-electric power for their farms.

Toronto, Ont.

The South Bay Power Company, Limited, have been incorporated to generate and transmit power within the districts of Sudbury and Temiskaming. Capital stock $1,000,000; head office, Toronto.

Vancouver, B.C.

Nearly 100 members of the British Columbia Electric Railway Company's office staffs attended the annual dinner of the British Columbia Electric Social Club, held at Vancouver recently. Addresses were delivered by various officials of the company, Mr. A. T. Goward, manager of the Victoria branch, responding to the toast, "British Columbia and Our Men at the Front."

Welland, Ont.

Work is to be proceeded with at once on the construction of a new transformer station for the Welland Hydro-electric Power Commission, Welland, Ont. The building will be of brick, 38 feet wide, 60 feet long and 40 feet high. It will consist of two storeys and basement. Foundation to be of concrete, superstructure brick and stone and girders of steel. This station will have a capacity of approximately 5,000 h.p. at the beginning, with provision for an additional 5,000 h.p. when necessary. Cost is estimated will reach $50,000, including equipment.

Winnipeg, Man.

The Mansbridge-Gray Electric Heater Company, Limited, Winnipeg, Man., has been incorporated.

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Generation, Transmission and Application of Electricity

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Vol. 26 Toronto, January 15, 1917 No. 2

Electric House Heating

A few short years ago experimental data on electric cooking was looked upon as more or less of a curiosity and as indicating a "consummation devoutly to be wished" rather than a possibility of the near future so early to be realized. Just so to-day, electric heating appears dimly on the horizon, and we are watching eagerly for figures that may indicate greater possibilities than we have dared to hope for. Unfortunately the problems are somewhat dissimilar and not so favorable for electric heating as, in the case of the electric range, there were possibilities of betterments in efficiency which are denied us in our study of electric heating. The bald fact is that electric current must be procurable at somewhere between one-half and one-quarter cent per kw.h. before we can heat our homes as cheaply as with anthracite coal at $8 or $9 a ton. Of course, there are many compensating features in the use of electric heating which will not be measured in dollars and cents by the householder who can afford a slightly larger expenditure, but, as has been demonstrated in the case of electric cooking, this new idea must have time to develop.

Some very interesting experimental figures are printed in this issue, of tests made by Professor Osborn down in Seattle. There is nothing in these experiments, apparently, which does not bear out the theory of the subject, and, indeed, the coincidence between the experimental data and the figures published at different times in the Electrical News, and more particularly in our editorial of September 15, 1916, is quite noticeable. It will further be seen from this article that the capacity found necessary in the experimental installation, where the temperature does not [illegible] most Canadian localities, runs as high as 2.5 watts per cubic foot of room volume, and it is safe to say that anything less than this would prove unsatisfactory in this country.

The Chippewa Development

The New Year's vote on the Chippewa hydro-electric development scheme, which a large number of municipalities in southwestern Ontario were asked by the Hydro-electric Power Commission of Ontario to pass upon at the recent elections, showed that all but two were favorable to going forward with the work. This vote gives the commission authority to proceed with the perfecting of the details of this scheme, including the preparation of cost estimates and the apportionment of this cost. When this work is completed each municipality will again be given the opportunity to pass upon a perfectly definite and clearly defined proposition in which they will know just what sum of money they, individually, will be held responsible for, and what they may expect in return for this responsibility. Should this second vote be favorable the commission will then have a free hand to proceed with the development. The two municipalities that failed to endorse the scheme as recently submitted were Goderich and Waterford.

Technical Men and the War

As announced in our issue of January 1st, an open meeting of engineers from all the technical organizations with representatives in Toronto was held in the Engineers' Club rooms in that city on December 28th, to discuss the possibility of formulating plans whereby they may give their services in some technical capacity to assist in the carrying on of our war. A committee was appointed, consisting of one member—the chairman in most cases—from each organization represented. These nominations were made subject to ratification by the individual organizations, most of which have already expressed their approval, and action is being taken immediately by the others. The committee has already held several meetings, has drawn up a set of by-laws to govern its actions, has initiated a movement to list and classify all the technical men in the province, and has approached the societies and society branches of the other provinces with a view to enlisting the co-operation of the entire engineering personnel of the Dominion.

Ways and means of utilizing their technical knowledge and experience in furthering the war has formed the basis of discussion at these meetings, and it is urged that engineers everywhere in Ontario, in whatever capacity or work employed, turn this important matter over in their minds and forward suggestions to the secretary of the committee, which is to be known as the "Joint Committee of Technical Organizations (Toronto branch)." The secretary is Mr. Wills Maclachlan, Excelsior Life Building, Toronto. He will be glad to hear from outside engineers, so that the joint committee may have assurance that they have the co-operation of the profession as a whole. Any suggestions made will be gratefully received and most carefully considered by the committee.

Fixation of Atmospheric Nitrogen

A timely article appears in this issue by Dr. L. A. Herdt, professor of electrical engineering at McGill University, Montreal, on the subject of "Fixation of Atmospheric Nitrogen." The article points to the tremendous importance of nitrogen and nitrogen compounds in peace, as well as war times; the probability of the early depletion of the principal sources of world supply, and the economic possibilities in connection with the extraction of nitrogen from the atmosphere by electrical means, as a result of the ample water power resources, as yet undeveloped, in Canada. As a war measure or as a preparation for the active commercial competition which is certain to follow the declaration of peace, it is doubtful if our government or our engineers could spend their time to better advantage right at the present moment than in a most searching investigation into this whole matter.

Demand for Hydro-electric Equipment in Quebec Province

The demand for electrical equipment and supplies, especially motors, in the Montreal district continues very brisk. The call for motors is, to a large extent, due to munition requirements and also, in the province, to the activity in the pulp and paper industries. Electrical drive in factories of all descriptions is increasing, and with this, of course, comes the demand for current, which has grown to an enormous extent during the last few years. With regard to supplies, firms in this branch report that business is very good, and that the great difficulty is to obtain raw materials, even at the largely enhanced prices ruling.

The Chicoutimi Pulp Company has just purchased a large amount of electrical and hydro machinery for itself and subsidiary concerns, with a view of extending operations. The contract for the supply of the electrical equipment has been closed with the Canadian Westinghouse Company and with the S. Morgan Smith Company, York, Pa., for the turbines. At the Chicoutimi Company's plant at Pont Arnault two 1,875 kv.a., 2,000 v., three-phase, 7,200 alternations, 277 r.p.m. water-wheel generators will be installed, together with a 125 kw., 125 v., 500 r.p.m. water wheel exciter unit, 12-625 kv.a. transformers of 12,500 v. high tension and 2,200 v. low tension, 60 cycles, and a switchboard for the power house. The two turbines by the S. Morgan Smith Company are to be each of 2,500 h.p. direct connected to the generators, and the exciter turbine is to be of 175 h.p. The turbines will work under a head of 53 feet. They are to be fitted with Lombard oil-pressure governors. The present plant consists of one generator turbine and one exciter turbine of the same capacity as the new equipment. For the pulp mill at Chicoutimi a voltage regulator, two 1,800 h.p., 2,200 v., three-phase, 60 cycle, 257 r.p.m. motors for the pulp grinders, with switchboard equipment, has been ordered.

At the plant at Ouiatchouan Falls a 750 kv.a., 550 v., three-phase, 60 cycle, 720 r.p.m. water wheel generator, an exciter, and a switchboard will be installed.

Machinery for the Saguenay Light and Power Company at Bagotville, comprises a 750 kv.a., 2,200 v., three-phase, 7,200 alternations, 514 r.p.m., water wheel generator, an exciter, and a switchboard. For the Ha! Ha! Bay Sulphite Company, also at Bagotville, 40 motors of various sizes for the new sulphite mill and apparatus for the sub-station, consisting of step-down transformers and switchboard equipment, have been contracted for.

Tungsten Manufacture

The new works which have been erected in Widnes for the manufacture of tungsten powder is an example of what British enterprise and brains can achieve when thoroughly roused. Many of our readers are no doubt aware of the serious position in which the makers of high speed steel, amongst other commodities, were placed soon after the outbreak of war, owing to the supply of tungsten powder having been permitted to drift almost exclusively into the hands of a monopolist firm, and German at that. It was a similar predicament to that in which the textile industries found themselves with regard to the supply of dye-stuffs. The alarming position in both cases soon roused the government to take action, so that the very great demand for such essential materials should be made good as far as possible in the period of stress caused by the war. Arrangements were quickly made for the wolfram mines in the Empire to confine their output to the Empire's needs, and funds were provided for the erection of a tungsten-perodes works. A strong committee of steel makers was formed, at the head of which was Mr. Arthur Balfour, of Sheffield. The committee was fortunate in securing the services of Mr. Vogel, who had previous experience in the production of tungsten powder, and in a very short space of time a plant was laid down in close proximity to the United Alkali Company's works, so as to ensure an ample supply of hydrochloric acid. The works have now been in full swing for almost twenty-one months, and in this short space of time a product has been arrived at of greater purity than that which the Germans have taken as many years to attain. The output is on an average three tons per day, which is probably enough to meet requirements. Whether the works will pay or not is a subject which was much discussed when they were visited by a large party ten days ago. It is certain that had they been put down before the war, Germany would have endeavored to crush them out of existence by ruthless undercutting. That must not be allowed to occur after the war; on that everyone is agreed. The industry must be kept here whatever principles may have to be sacrificed in the keeping of it.—The Engineer.

Electrically Operated Metallurgical Works

The extent to which Canadian metallurgical works are now being operated electrically is shown by a list recently published by the Mines Branch of the Department of Mines, Ottawa, on "Metal mining and smelter operations in Canada, classified under the ore produced and then according to the location of the mine or works." This list shows that electric furnaces are used to produce ferro-alloys—ferro-phosphorus and ferro-silicon; also seventeen furnaces are now operating for reducing iron ores, these furnaces varying in capacity up to six tons. One large Canadian company is refining copper, lead and zinc electrolytically on a very considerable scale.

Power in Sherbrooke, Que.

As previously intimated in the Electrical News, the demands of the munition and other factories in Sherbrooke resulted in a shortage of electric power. The munition factories in particular were in urgent need of power in order that they might fill their contracts with the Imperial Munitions Board. The Sherbrooke Railway and Power Company, under their agreement with the city, have no right to sell direct to manufacturers, although they have a certain amount of surplus energy. Several conferences were recently held, and, as a result, it has been agreed that the Sherbrooke Railway and Power Company shall sell to the city 1,500 horse power, 1,200 of which will in turn be sold to the Canadian Ingersoll-Rand Company. For this purpose a new transmission line about a mile long has been built from the plant of the street railway company to the factory of the Rand company. Under a recent charter amendment the city obtained definite powers to buy and sell electric current. Mr. J. M. Robertson, of Montreal, was the technical representative of the railway company at the conferences, while the city of Sherbrooke was represented by Mr. M. A. Sammett, of Montreal.

The Fixation of Atmospheric Nitrogen

by Electrical Means and the Production of Nitric Acid and Nitrates—Address before Electrical Club, McGill University

By Prof. L. A. Herdt

My subject is not one which will permit of great flights of eloquence. I did not select the subject; it was selected for me, first of all, I believe, by Mr. Burr, and subsequently by your President. I had no objection to it, however; the subject is interesting. It deals with the manufacture of a product which in the words of Sir William Crookes "will postpone the day of famine, the day of starvation, to so distant a period that we and our sons and grandsons may legitimately live without undue solicitude for the future." Let me explain:

In 1898 Sir William Crookes, in his presidential address before the British Association for the Advancement of Science delivered at Bristol, alarmed at the rapid draining of the nitrate beds of South America, and well aware of the rapid impoverishment of the soil unless it is abundantly fertilized, voiced the following opinion, which sounded as a trumpet call over the whole world:

"By 1931, 231 million units will likely be added to the bread-eating population. Will the arable areas of the temperate zone now partially occupied grow the additional 330 million bushels of wheat required by a hungry world?"

He also added:—

"Before we are in the grip of actual dearth will the chemist step in and postpone the day of famine to so distant a period that we and our sons and grandsons may legitimately live without undue solicitude for the future?"

"The fixation of nitrogen is vital to the progress of civilized humanity. Other discoveries minister to an increased intellectual comfort, luxury or convenience; they serve to make life easier, to hasten the acquisition of wealth or to save time, health or worry; but the fixation of nitrogen unless we can class it among certainties to come, will mean the end of the great Caucasian race; it will be squeezed out of existence by races to whom wheat bread is not the staff of life."

These words were spoken in 1898, eighteen years ago Sir Wm. Crookes was calling to the scientific world to avert starvation of the world through the laboratory. A few years after this trumpet call in 1906, a large factory was placed in operation in Norway, manufacturing an artificial product the equivalent of Chilean saltpeter, or nitrate of soda, the best known of the imported fertilizers.

The industrial production of nitric acid and nitrates by utilizing electrical energy to cause the direct combination of atmospheric oxygen and nitrogen had been realized.

The Value of Nitrogen.

Nitrogen plays a great part in the vegetable kingdom. Plants must have nitrogen to live. It is a curious fact that only a few plants can draw upon the immense resources of free nitrogen existing in the atmosphere. The great majority of plants and vegetables, wheat, oats, corn, etc., are obliged to obtain the azolized or nitrogeneous compounds necessary to their life from the ground itself. The principal nitrogenized fertilizers are manure, dried blood, wool wastes, horn, leather, nitrate of soda, sulphate of ammonia, calcium cyanide and nitrate of lime. Of these the nitrate of soda, or Chili saltpeter, found in its natural state in immense deposits situated in Chili, Peru and Bolivia, is the principal fertilizer. It is a nitrogen compound.

In 1913-14, just before the war, the exportation from Chili for twelve months amounted to over 3,000,000 tons. In 1830 the exports of Chilean nitrate were only 100 tons; in 1870 they had increased to 150,000 tons; in 1904 to 1,500,000 tons; ten years later to over 3,000,000 tons.

Chili saltpeter was shipped from Chili to European countries before the war, mainly in English bottoms. It sold at a price of $45 per ton f.o.b. Liverpool, and gives an export tax of $12 a ton to the Chilean Government, or between $35,000,000 and $40,000,000 revenue.

Years of exploration have shown that the Chilean deposits are the only natural deposits of nitrates in the world situated in accessible regions. It is also well recognized that these are not inexhaustible. Exact valuations are not possible, but experts declare that exportation such as is taking place will empty the Chilean mines by the year 1940 at the latest. Whatever it may be, as these natural deposits are of limited extent, and as climatic and geological conditions of the country are such that these deposits are no longer forming, it is certain that their exhaustion will occur at some future date and that agriculture and industries depending on nitric acid for their manufacture, must look elsewhere for some similar product.

The nitrogenous compounds are used not only as fertilizers, but the compounds of nitrogen and oxygen are the nitric acid salts of commerce. The world's production of nitric acid is from 200,000 to 250,000 tons per year. Fifty per cent. of all the Chili saltpeter exported is used in the manufacture of explosives, as all explosives have a nitrogen compound as the principal ingredient. The original black gunpowder uses Chili saltpeter, charcoal and sulphur. Smokeless powder utilizes Chili saltpeter that is nitric acid, in its composition. All the high explosives, cordite, lyddite, mellenite, guncotton, etc., require the inherent molecular energy of oxygen in their production.

The fixation of nitrogen is vital to the progress of civilized humanity; but above all, the fixation of nitrogen is vital to such countries as may be or are now shut off from the Chilean field.. The recent realization of the industrial production of nitric acid and nitrates by utilizing electrical energy to cause the direct combination of atmospheric oxygen and nitrogen has enabled Germany and Austria to carry on this war whilst the soda nitrate fields were closed to them by Great Britain's command of the sea. We have here another instance of German preparedness.

The story of the fixation of atmospheric nitrogen can be summed up as follows:—

The problem itself has been worked upon for over a century, it being known that nature fixed nitrogen of the atmosphere by means of electric discharges, and Cavendish, in 1781, had shown that a small amount of nitrogen was converted into nitric acid in the combustion of hydrogen with oxygen to form water. Fixation processes experimented upon in the last twenty years are to be counted by the hundreds. The majority of these are still experimental. Of the various processes which have reached the state of commercial application, there are four distinct lines of development.

(1) The production of nitric acid directly from the atmosphere by means of the electric arc. In this process the nitrogen of the atmosphere is directly combined with its accompanying oxygen without utilizing any other chemical substances, the process consisting essentially of a powerful arc furnace through which air is forced, causing [illegible]

temperature the nitrogen to combine with the oxygen forming nitric oxide, NO.

(2) Fixing nitrogen by means of an electric furnace where the energy of chemical combination is utilized, causing the nitrogen to combine with some substances with which there is a pronounced energy of chemical combination. These processes include furnaces utilizing calcium carbide with which nitrogen readily combines to form calcium cyanide $CaCN_2$, and various processes for making combinations of nitrogen and a basic or alkaline earth metal such as calcium nitride CaN_2 or magnesium nitride, MG_3N_2 or Aluminum Nitride A1N, the chemical action usually forming a nitride or carbo-nitride.

(3) Processes for producing ammonia, NH_3, directly from nitrogen and hydrogen. These include the effort to use the various forms of electric discharge by which the nitrogen molecule may be decomposed, and in the presence of hydrogen form ammonia.

(4) Producing a high temperature by means of the explosion or combination of gases directly combining the nitrogen and oxygen to form nitric oxide, NO. The NO formed is recovered and converted into nitric acid HNO_3.

Nitrogen Compounds By Electric Arc.

The processes to which I shall confine my remarks are those enumerated in (1), namely, the production of nitric acid, nitrates or nitrides directly from the atmosphere by the oxidation of nitrogen or the fixation of nitrogen by means of electric arcs.

The production of nitric acid from air by electricity is based on the effect of the electric spark or arc on air. When an electric arc is discharged through air the air immediately surrounding it undergoes a change; the oxygen and nitrogen of the air unite to form NO and NO_2. The oxides of the nitrogen thus formed can be turned into nitric acid; and nitrates follow from a natural order of things, so to speak. At the beginning of this twentieth century, a whole series of experiments was made to lay out conditions for the attainment of an advantageous output of nitric acid for a given amount of electrical energy expended. These attempts were not very encouraging, and the commercial solution of the nitrogen problem seemed very far off.

Amongst such experimenters can be cited Gaye in Switzerland, Bradley and, Lovejoy in the United States, Kowalski and Moscicki in Freiburg. The fundamental idea running all through their experiments is the necessity of obtaining electric arcs of the greatest possible length and smallest possible section in order that the greatest volume of air might be brought into contact with the surface of the arc. This meant high voltages and multiplicity of arcs.

Bradley and Lovejoy, in their installation at Niagara used electric furnaces, where the arcs were struck between movable contacts, and they obtained a countless number of small arcs, as much as 400,000 per minute in a furnace of a few kilowatts. The apparatus was complicated and costly, as well as subjected to very rapid deterioration. A large amount of power was required to rotate large iron cylinders forming the furnaces, and the yield was so small that the cost of production on a large scale was greater than the corresponding price for sodium nitrate.

Birkeland and Eyde, in Norway, in 1903, had observed that the electric discharges of a moderately high voltage alternating current is spread out in the form of a circular sheet when subjected to a magnetic field, and that in passing air through that luminous sheet the oxidation of nitrogen was greatly accelerated. They saw the possibility of using lower voltages, greater units and less costly apparatus, and therefore of obtaining much cheaper cost of manufacture.

The Birkeland and Eyde furnace has been extensively used. Its most distinctive features are the use of electromagnets which distort the flame extending radially outward from the electrodes. The air enters the furnace and is distributed to the arc through holes in the firebrick lining of the furnace. The products are withdrawn from the periphery of the furnace.

The electrodes are tube copper electrodes placed equatorially between the poles of the powerful electromagnets. The electrodes are water cooled and are placed about ⅜ in. apart. The working potential between electrodes is 5,000 volts at 50 cycles. When the flame is burning it emits a loud noise due to the interruption of the arcs. From oscillographic test it has been observed that a series of rapidly expanding arcs are formed in the flame at each reversal of current, and that several hundred arcs per second are formed, although the alternating current employed has fifty periods per second. As the arcs travel radially outward the contact of the ionized arc stream with the incoming air disrupts the nitrogen molecule and causes the formation of NO and the gaseous products travel rapidly to the periphery of the furnace, where they are withdrawn at an average temperature of about 1,250 degrees cent. The concentration is from 1 to 1.5 per cent. of NO.

There were at the time of my visit to this plant at Notodden, Norway, 32 electric furnaces of 1,000 e.h.p. each, installed in this one room. The more recent furnaces of Birkeland and Eyde are of 3,000 kw. capacity each, and give concentrations of two per cent. NO, and a yield of 580 to 600 kilograms of nitric acid per kw. year.

To provide the energy for this plant a large hydro electric plant has been built at Svaelgpos by this company. Four wheels working under a head of 120 feet are directly coupled to four electric generators of 10,000 kw. each, giving a total of 42,000 kw. Energy is transmitted to Notodden, a distance of four miles, at 5,000 volts, through three heavy transmission lines, of two circuits each.

The air or gas that comes from the electric furnaces at a temperature of from 1,000 to 1,200 degs. cent. are passed through steam boilers to cool them. The steam thus raised is employed in the further manufacture of the ultimate product, calcium nitrate. The temperature of the gases is thus brought down to about 200 degs., but they are further cooled to about 50 degs. in a cooling apparatus. The gases then enter into absorption towers, where the gas is converted into nitric acid. The absorption system consists of huge stone towers 63 feet high by 35 feet in diameter, over which water and the nitric acid formed are made to trickle. Acid is concentrated up to 50 per cent., at which density it is pumped to open granite tanks, where it is temporarily stored. The acid is then carried to a series of granite tanks, where reaching ordinary limestone, it is converted into a neutral solution of calcium nitrate. This neutral lye is carried further into vaporization chambers of iron, where it is vaporized to a boiling point answering to a concentration of from 75 to 80 per cent. of calcium nitrate containing about 13.5 per cent. of nitrogen. This substance is then run into drums, where it congeals, and in that form appears on the market.

Nitric acid of commerce is manufactured from soda nitrate by treatment with sulphuric acid, about 72 per cent. of the sodium nitrate being nitric acid.

What Foreign Countries Are Doing.

The Norwegian Nitrogen Company and its subsidiary companies, have undertaken solely for the needs of their industry the construction of a number of hydro-electric plants, the total capacity of which will reach the figure of 540,000 h.p. Four plants of 180,000 h.p. were in operation in 1914. 720,000 h.p. will produce 250,000 tons of nitrate a year. In 1911 Germany imported 725,000 tons of nitrate of soda nitre, while England imported 135,000 tons only. When it is remembered that the Chilean saltpeter is the base of the manufacture of powder and explosives, these figures tell a tale.

The Norwegian plants were built in 1904 to 1907, with French money. At Notodden and Rjukafos, in a valley that ten years ago contained five houses, there was in 1910 a town of 10,000 inhabitants, with a power plant of 250,000 h.p. shipping the nitrate of lime to Hamburg, Germany.

The thing that makes the process most interesting is its wonderful inefficiency from the thermal and energy standpoint. There is actually used at Rjukafos, Norway, 250,000 h.p., but there is actually utilized for the chemical operation 3,500 h.p. All the rest of the 250,000 h.p. is lost—the efficiency of the operation being 1.4 per cent. of the power used. The wonderful room for improvement is one of the most interesting and attractive researches to the electro-chemical engineer.

The most important factor upon which the cheapness of the process depends is cheap power, as it requires practically 3 e.h.p. years at the electric plant per ton of nitrate. Cheap and large sources of power must be used to make the investment profitable.

Electrical energy in Norway is figured at $7 per h.p. year, interest and depreciation included. If all the known water power in Norway were harnessed to develop electrical energy, and this energy used for the production of calcium nitrate, the production would not be one-tenth of the world's consumption to-day.

It therefore seems certain that before the 25 years shall have elapsed since Sir Wm. Crookes made his memorable address, the Chili nitrate beds will have vastly curtailed their production—not from exhaustion—but from the inroads made by the onward advance of electro-chemical engineering.

To those interested in the problem I would refer them to a paper by Summers entitled Atmospheric Nitrogen, A.I.E.E., 1915. The theoretical limitation imposed by the laws of physical chemistry to such process involving chemical dynamics are set forth at length.

Experiments in House-heating by Electricity

By Frederick A. Osborn*

The possibility of having our homes heated by electricity has for some years been claiming more and more attention. The many advantages of electric heating, the quickness and ease of the temperature control, its freedom from dirt in the rooms and in the basement, the ability to place the heater where it is most needed—all these advantages and others have aroused the interest of many and raised hopes that in the Pacific Northwest, with its abundant water sources, electric heating was not far distant.

It seemed desirable, therefore, to make a careful comparison of the cost of heating an average-sized house by coal and by electricity. The dwelling used in the experiments was the author's own residence. That the comparison of cost might be fair, it was decided to make the number of rooms heated by each system the same, and as far as possible to maintain during each test the same average room temperatures. The details of the experiment follow.

The house is ordinarily heated by an 024 Standard hot-air furnace. For the past three years a high grade of lump coal has been used, costing for the present year $7.75 per ton in the basement bin. The average cost of heating the house, including the wood used in the fireplace, has been about $75 a year for the last three years.

All the rooms heated were equipped with the wire-resistance convector type of electric heater. In the dining room a hot-water radiator, to which was attached an induction-type electric heater, was used during a part of the time.

The living room, with a volume of 2,400 cubic feet, had two 3,000-watt heaters, with three heat controls. The maximum wattage was 2.5 watts per cubic foot.

The study, a room of 1,300 cubic feet, had one 600-watt heater. The power taken per cubic foot was 0.46 watt. The temperature of the study seldom was above 64 degs. and this was by choice.

The dining room has a volume of 1,410 cubic feet. It was supplied with one 2,000-watt heater, and for a part of the time a 2,500-watt water radiator was used. The maximum demand was 1.4 watts per cubic foot.

The kitchen and pantry, with a volume of 500 cubic feet, had a 1,000-watt heater. This heater was for most of the time on the low heat, taking about 300 watts, the gas range when the oven was in use furnishing the necessary heat.

The south bedroom, volume 1,320 cubic feet, had one 2,000-watt heater. This room is used also as a sewing room, and is warmed nearly every afternoon.

The bathroom on the north, with a volume of 350 cubic feet, had one 1,000-watt heater, kept on the low heat most of the time.

As the entire test was carried out with one type of heater, the question will naturally arise, may not some other type of electric heater be more efficient than the type used? Electric heating differs from all other systems of heating in that all electric heaters of the same wattage are equally efficient. They will all deliver the same number of heat units to the room. In furnace heating the amount of heat escaping up the chimney depends upon the furnace, the method of firing it and other factors not constant. The heat given to the room is that which is not lost in the furnace, the flues and the transmitting pipes from furnace to the room. Coal furnaces deliver from 40 per cent. to 60 per cent. of the heat in the coal to the rooms.

Table 1—Test with Hot-air Furnace

Week of	Average outside temperature, deg. F.	Average living room temperature		Coal consumption, lb.
		8 a.m to 10 p.m., deg.	10 p.m to 8 a.m. deg.	
December 1-8	49.2	67.7	62.8	631
December 8-15	43.5	65.7	60.0	667
December 15-22 . ..	44.0	65.8	61.1	560
December 22-29 . ..	39.5	65.8	61.0	660
Dec. 29-Jan. 5 . ..	29.4	66.0	59.0	780
January 5-12	33.0	65.0	58.0	755
January 12-19	29.0	67.0	58.0	837

Electric heaters, on the other hand, deliver practically 100 per cent. of the heat to the rooms. For each kilowatt-hour of electrical energy put into any type of electric heater, the same amount of heat is furnished. There may be some minor advantages in using one type of electric heater in preference to another type, but this advantage never consists in getting more or less heat units from a kilowatt-hour of electrical energy. This fact needs to be kept constantly in mind when discussing the advantages of electric heaters.

Throughout the entire test a recording thermometer giving continuous readings of the temperature was kept in the same position in the living room. The thermometer was on the piano. In the dining room a second recording thermometer was placed on the plate rail.

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*Prof. of Physics, University of Washington, Seattle, in Electrical World

The outside temperature was taken from the recording thermometers at the university after a recording thermometer at the house gave evidence that the outside temperature at the house and the university did not differ by more than a degree.

The dining room thermometer as well as the one in the study was used in each part of the test to determine the similar heating conditions under the two systems, and when this was established they were read only occasionally.

Test with Hot-air Furnace

This test was begun December 1 and continued until January 19. During this period Seattle had the coldest weather of the season. The coal used was carefully weighed, part of the time daily, and later the coal for two or three days' burning was weighed at one time. In Table 1 is found the record of the test.

The average outside temperature for the seven weeks was 38.2 degs. Fahr., the day room temperature was 66.1 degs. Fahr., and the night room temperature was 59.9 degs. Fahr. During the day the room was maintained at an average temperature of 27.9 degs. Fahr. above the average outside temperature. The total coal consumption was 4,890 lbs., or an average of 698 lbs. per week. The total cost of the coal at $7.75 a ton was $18.95, or an average of $2.42 per week.

Test with Electric Heat

This part of the test began on February 1 and continued until March 14. The detailed record appears in Table 2.

Table 2—Test with Electric Heating

Week of	Average outside temperature, deg. F	Average living room temperature		Kilowatt-hours used
		8 a.m. to 10 p.m., deg. F	10 p.m. to 8 a.m., deg. F	
February 1-8	36.3	67.0	57.5	1039
February 8-15	46.7	67.3	60.0	741
February 15-22	41.9	66.0	58.4	575
February 22-29	40.5	66.5	56.4	573
Feb. 29-March 7 ..	36.0	64.0	56.0	794
March 7-14	47.6	66.5	57.6	522

The average outside temperature for the six weeks was 41.5 degs. Fahr., the day room temperature 66.2 degs. Fahr., the night room temperature 57.6 degs. Fahr. The living room was maintained at an average temperature of 24.7 degs. Fahr. above the outside temperature. The total number of kilowatt-hours used was 4274, or an average of 712.3 per week. The cost of the six weeks at 1 cent a kilowatt-hour was $42.74, or an average cost of $7.12 per week. To this cost should be added $2.50 for heating by gas the water used for domestic purposes. The furnace having a water coil in it furnished the hot water in the first test.

If we assume that the loss of heat from a room is proportional to the difference in temperature between the outside and the inside, then the furnace furnished to the rooms 279/247 = 1.12, or 12 per cent. more heat, and the consumption of electrical energy for the same amount of heat would have been 4787 kw.-hr. Taking into consideration then the cost for water heating and for furnishing the same amount of heat, the cost for electric heating under the same conditions as obtained during the furnace heating would have been $50.37, or $8.39 per week. This makes electric heating cost [illegible]46 times that for coal under like conditions.

From this test, electricity selling at 0.29 cent per kilowatt-hour would furnish heat for the same cost as coal at $7.75 a ton. To many the advantages of electric heating are worth a 50 per cent. increase in the cost of heating, and electricity at about one-half a cent per kilowatt-hour would make this possible.

Handling Telephone Traffic

"Handling Telephone Traffic" was the subject of a paper read by Mr. J. A. Anderson, traffic manager of the Bell Telephone Company, at the Montreal electrical luncheon held on January 3rd. He stated that in the city of Montreal there were eight central offices and long distance, 54,000 telephones, about 550,000 originating calls every twenty-four hours, 55 per cent. of which are "trunked," making approximately 850,000 connections, about 10 per cent. of these taking place during the busy hour of the day. There was a staff of 1,400 people handling this traffic. Private switchboards, with the exceptions of the hotels, pay stations, and the City Hall, were under the control of the subscribers, but the Bell Telephone Company exercised supervision in order to see that the proper standard of service was maintained.

The type of service in Montreal was known as "flat rate" that was, subscribers paid a fixed annual charge for the service. In large cities throughout the United States the service was on a measured service basis—that was so much per call.. As showing the difference made where people had unlimited service, or a "pay as you go," Mr. Anderson stated that the average number of calls per telephone in Montreal was 11, as compared with 7 in the American cities on a measured service basis, or a difference of about 57 per cent. As a consequence of the difference in this calling rate it was very much more expensive to operate each telephone in Montreal than it was to operate, for example, each telephone in the city of New York, as the number of lines an operator could handle and maintain the grade of service which it was considered subscribers should get in order to be satisfactory was very much less. This difference was felt throughout the whole central office system, as it meant a switchboard materially larger and also a greater number of operators.

Mr. Anderson then described the method of training operators, the proper way to give and receive calls, the working of an exchange fom the operating point of view, and the method of dealing with long distance calls. He also referred in detail to the difficulties attending telephone work, and to the complaints by the public, many of which he explained were due to the faults of subscribers. While he did not claim perfection for the company, he pointed out that many people were to blame by reason of their failure to take reasonable measures in order to get satisfactory service. The company adopted every possible precaution to give the most efficient service, but looked for co-operation of the public with a view to that end.

In their central station in Montreal the company have provided luncheon and rest rooms for the operators, and have also provided a summer resort at Lake L'Achigan, where the operators could obtain a holiday at a comparatively small cost. This was not done on philanthropic grounds, but because it was good business.

Electrical Engineers Meet in Pittsburgh to Discuss Important Question

The American Institute of Electrical Engineers held its first meeting at Pittsburgh on January 12th, 1917, with headquarters at the Fort Pitt Hotel. Following the policy adopted a short time ago, the Institute, instead of confining its session to one annual meeting during the year, has decided to hold several meetings at stated intervals in various parts of the country. The Pittsburgh meeting was devoted to a discussion of "Braking Electric Vehicles by Regeneration," using the energy generated on down grades to apply brakes to the vehicles. The paper on this subject was presented by Mr. R. E. Hellmund, of the Westinghouse Electric & Mfg. Company. This article is reproduced in part on the following pages.

Electric Railways

Regenerative Braking on Electric Railways—A Brief Explanation and Review of the Principles Involved—Assuming Great Commercial Importance

By Mr. R. E. Hellmund

The fact that a motor driving an electric vehicle may, under certain conditions, be converted into a generator and that it will as such exert a braking effect upon the vehicle instead of propelling it, was known very soon after the electric propulsion of vehicles was introduced.

This braking effect may be utilized under two conditions: first, when the vehicle is going down hill, for the purpose of avoiding undesirable acceleration, due to gravity, and consequent high speeds; second, after a vehicle has reached a certain speed and it is desirable to reduce this speed to a lower speed or to standstill.

The electric energy generated while braking the vehicle in this manner may be disposed of in two ways: first, it may be used up in resistances mounted on the vehicle, in which case it is customary to speak of dynamic braking; second, it may be returned to the power supply system, in which case it is customary to speak of regenerative braking. A combination of the two cases is, of course, possible and may be found advantageous in certain applications. Since in any of these cases dynamic braking takes place, it would be better to use the terms:

1. Resistance braking.
2. Regenerative braking.
3. Combined resistance and regenerative braking.

This paper deals with regenerative braking in particular.

Common to all three cases of electrodynamic braking, are the following advantages over purely mechanical braking:

1. Reduced wear of mechanical braking devices, which, in the case of electric railways, usually results in reduced maintenance cost for wheels and brake shoes.

2. Greater ease and safety in handling the vehicle during the braking period under certain conditions, which results, especially in handling heavy freight trains, in reduced maintenance of couplings and other parts of the cars.

3. Higher permissible average speed in descending grades in certain applications. The braking effect with air brakes cannot be kept constant, so that speed variations will result, when going down grade. Due to these variations, the average speed is appreciably below the maximum safe speed. With electrodynamic braking without the assistance of air brakes, much closer speed control is possible, so that the average speed can be held much closer to the maximum permissible speed.

4. Increased safety by elimination or at least reduction of tire heating caused by brake shoe friction and resulting in loose tires and accidents.

Regenerative braking has the further marked advantages, namely:—

5. Power economy which amounts in many cases to a saving of 15 per cent. or more in the total power consumption.

6. In connection with subways where generation of heat in the tunnels is very objectionable, regeneration is very advantageous, as it permits the elimination of an appreciable part of the heat now generated by the mechanical braking system.

It may safely be stated that wherever it seems worth while, the above advantages may be secured in the present state of the art, both on running down grades and during retardation, with any of the systems or types of motors which are now used for the operation of electric vehicles, although commercial systems have been developed, up to the present, for only a few cases.

The requirements necessary to accomplish these results are as follows, and are either partly or in their entirety, dependent upon the system, service conditions, etc.

Outline of Requirements.

1. Increased current capacity of the main motors and such transforming or converting apparatus as may be located on the vehicle for the purpose of converting power for the main motors. This is evident because the braking current flowing in the motor, etc., naturally raises the r.m.s. or heating currents. This increase may be appreciable when regeneration is used for stopping trains in local passenger traffic, while it may be rather small in the case of freight locomotives descending grades.

Increased current capacity necessitates, in turn, either increased dimensions of all apparatus affected thereby, or increased ventilation, which may at times be attained by increased capacity of existing ventilating equipments, or by introducing additional ventilating equipment. Where the motors are not loaded to their full capacity for propelling purposes, these requirements may, of course, not exist.

2. Adaptation of the motor bearings and other mechanical parts to regenerative operation, where necessary.

3. Additional equipment on the vehicle for the purpose of controlling and safeguarding the regenerative operation and to give, where necessary, the desirable regenerating characteristic to the motors.

4. Additional equipment in the generating or transforming stations for the purpose of controlling the operation in connection with special conditions brought about by regenerative braking.

5. Adjustment of the system wherever necessary due to the increased tendency towards voltage variation introduced by regenerative braking.

6. Modification of train dispatching, so as always to have a load on the line utilizing the regenerated current, in cases where maximum economy in power consumption is of prime importance.

The fulfilment of these requirements as far as they exist in the various systems introduces the following disadvantages of some importance, which have to be compared with the advantages previously enumerated:

1. Increased weight of vehicle equipment, necessitating, sometimes, increased weight of the mechanical vehicle parts.

2. Increased first cost of vehicle equipment, necessitating, sometimes, increased first cost of the vehicle parts.

3. Increased cost of maintenance of the vehicle equipment.

4. Increased complication and consequent reduced reliability of operation of the equipment. This will under certain conditions, of course, also impair the safety with which the vehicle may be operated.

5. Increased complication and consequent reduced reliability of the power house, sub-stations and line protecting apparatus. (While some additional complications may be required in the generating and transmitting system, due to the addition of certain controlling apparatus, the weight and cost of the same is usually so low that it is of no practical importance and usually more than outweighed by the gains made in the reduction in size of apparatus made possible by the reduced power requirements).

6. Increased first cost for copper in the transmission system, or for introduction of other means, to compensate, where necessary, for the increased tendency towards voltage variation, whensoever such tendency exists.

Varying Conditions.

The relative importance of the various advantages and disadvantages given above depends, of course, to a large extent upon the individual system applied and upon service conditions. It is evident, for instance, that the importance of power economy depends largely upon the cost of power as part of the total operating expense, and that the advantage of power economy may be entirely eliminated where water power is available in abundance. The latter condition is, of course, as a rule only temporary, because it is to be expected in practically all cases that any such abundance will in time be eliminated by an increased market for electric power.

While the disadvantages, and their importance, vary also in each case, a number of facts apply pretty generally to all systems, and under most service conditions. It is a fact, for instance, that most of the disadvantages enumerated are not of very great practical importance in most cases where conditions are such that the saving in power consumption, made possible by regeneration, is appreciable, say 10 to 15 per cent. or more, or where an equivalent saving or gain is brought about in the maintenance of brake shoes, wheels, increased operating speeds, or the like.

The increased weight of the vehicle equipment and of the vehicle is usually disadvantageous only insofar as it tends to increase the power consumption during acceleration and running. In all but exceptional cases, this increase in power consumption is, however, smaller than the saving made possible by regenerative control, and in many cases it amounts to only a very small percentage of the same. Therefore, the increased weight does not really mean a disadvantage, but merely reduces the advantage of regenerative braking by a certain, and often very small, amount. There are, of course, cases of locomotives where the maximum permissible weight on the drivers is the limiting feature of the design, and any increase of weight may be quite a handicap in such cases.

Similar conditions apply to the increased first cost of the vehicle equipment and the interest and depreciation charges connected therewith. The latter represent again in many cases only a very small percentage of the saving made possible by regenerative control.

In some cases of old equipment where the main motors cannot be readily increased in capacity to take care of the regeneration, or where the mechanical parts, like the bearings, do not operate properly with regeneration, also where extensive changes in the generating and transmission system are necessary, the first cost for introducing regeneration may, of course, make the change prohibitive.

The increased cost of maintenance is in connection with many of the systems not very large, and of no practical importance, as it represents a very small percentage of the saving in power consumption brought about with regenerative control.

The additional complication in the power house or transmission system is also rather small and usually consists, where at all necessary, only in some automatic means for dissipating whatever small amount of energy may at times be regenerated in excess of the energy required for propelling the other vehicles and other loads on the system.

The disadvantages resulting from the increased tendency towards voltage variation which may be introduced by regeneration depends largely upon the individual case. In a system where a large number of individual vehicles is operated at all times, as in surface lines, elevated and subway lines in the centre of large cities, there will practically always be a large demand for the regenerative current by other vehicles and the result will be not only that the average power taken from the power house is reduced, but also that the maximum demand, and with it, the maximum voltage drop is reduced. In such cases there is, of course, no disadvantage on this score.

On the other hand, there are certain systems where so few trains or vehicles are on the line that it may happen that, at the time of maximum demand for propelling, none of the vehicles is regenerating and that, consequently, no reduction of the maximum power demand, and therefore, no reduction of maximum drop, is accomplished. At other times it may happen that on a certain line one or more vehicles are heavily regenerating while no power, or only a small amount of power, is being drawn from the line. In such a case the voltage drop will, of course, be negative. In other words, there is a voltage rise over the no-load voltage, bringing about an increased total voltage variation.

In many cases such an increase in voltage variation is of no practical importance. In other cases, where the car lighting system is dependent upon the line voltage, or where the main motors, auxiliary motors or generating apparatus are sensitive to voltage rises, the increased voltage variation may require some compensating means. In cases where the car lighting system is affected, it may be found desirable to make it independent of the line voltage by installing special car lighting apparatus. Usually, however, it will be found best to compensate for the increased tendency towards voltage variation by a slight increase in line copper, etc. In certain exceptional cases this might prove to be an item of no small importance against the introduction of regenerative control, on account of first cost. Since the increased line capacity tends, however, to improve the efficiency of the system, the first cost may, even in such cases, be largely compensated by reduced losses in the line. The cases in which the consideration of line regulation are of very great importance are rather rare; and in most cases of the present large properties which, as a matter of course, are the first ones to consider regenerative control, this disadvantage either will not exist or will be of comparatively little importance.

Complications Have Outweighed Advantages.

In view of the above, and in view of the fact that great efforts have been made to reduce power consumption by other means, like reduction of equipment and car weight, field control, coasting clocks, etc., it is rather surprising that regenerative control has not been used to a greater extent in the past. The only reason for this could be that the increased complication and consequent reduced reliability were considered as a sufficient disadvantage to outweigh the advantages. As long as the various types of controlling and protecting apparatus, as well as the operating characteristics of certain motors during regeneration, had not been developed to such a high degree of reliability as has been attained in many of the up-to-date apparatus and systems, this was undoubtedly a very sound and sufficient reason. With the present advanced state and knowledge of the art, however, this condition has changed, and although some difficulties have to be overcome with the various systems, there is no doubt but that the requirements for reliability and safety can be successfully met, in spite of some additional complication necessary, to a larger or smaller degree, in the various cases. For this reason the subject of regeneration is well worth serious consideration, and the brief outline of the various possible systems given in this paper may be of interest. As a matter of course, the development along these lines will, in the future, as in the past, follow the path of least resistance and the systems requiring the least complication and interfering the least with the reliability of equipment for propelling purposes will be introduced first.

In describing the various systems of regenerative braking, special attention has been paid to those which are adapted for demonstrating some fundamental principle, or to those which are especially important and promising with regard to practical application; many other systems are by necessity mentioned very briefly, or entirely omitted.

Conclusion

The author then describes at length a number of different systems of regenerative braking,—3-phase system, phase converter system, direct current system, a.c. commutator motor system, vapor converter system—and concludes as follows:—

In view of the numerous possibilities for successful regeneration, it is to be expected that regenerative braking will soon assume great commercial importance. It should, therefore, be exhaustively considered in any new electrification, and the time is approaching when its possible application should be investigated for the larger existing non-regenerative installations. In view of the practical advantages of regeneration for heavy railroad work, it is even quite likely that regeneration will in time become one of the factors which will win some railroads, now operated by steam, over to the electric cause.

Presentation at St. John's, P.Q.

On Saturday evening, December 16th, 1916, an interesting ceremony took place in St. John's, where Mr. F. A. Chisholm, former superintendent of the St. John's division of the Southern Canada Power Company, was the recipient of a very handsome gold watch and chain. This was subscribed to by the prominent business men of St. John's, who held a banquet in Mr. Chisholm's honor, and made it the occasion of a public presentation of this souvenir. The mayors of St. John's and Iberville and J. D. Demers, M.P., were present and spoke of the very efficient manner in which Mr. Chisholm had conducted the affairs of the company, and how he had always worked in good harmony with the official heads of the two townships. Mr. Chisholm is very popular both with the English and French speaking people of the district. This good feeling was testified to in several speeches.

Mr. Chisholm has been appointed superintendent of the Sherbrooke Railway and Power Company, and carries with him all good wishes for his future success from the people of St. John's.

Hydro Radial Scheme

As indicating the attitude, favorable for the most part, of the various municipalities in southwestern Ontario towards the hydro-radial policy of the Hydro-electric Power Commission of Ontario, we give the following table showing the relative vote, for and against, the two propositions submitted at the New Year elections. It is not yet clear just what action this vote authorizes the Commission to take, as, on account of the lack of unanimity of opinion, it would appear that some of the most important links in the whole chain of transportation are missing. That is true, however, of the larger scheme of the two only—the Port Credit-Hamilton-St. Catharines line. For the other section of the road, linking up Welland, Port Colborne and Bridgeburg, the vote appears to have been overwhelmingly in favor in every case, so that, unless the two schemes are interlinked, and each dependent upon the other, the commission now apparently has a definite mandate to proceed with construction work. The figures of the vote so far received are as follows:

Port Credit-Hamilton-St. Catharines

Townships	For	Against
Toronto	231	120
Trafalgar	138	47
Nelson	Defeated	
East Flamboro	Carried	
Barton	436	324
Saltfleet	Defeated	
North Grimsby	Carried	
Clinton	150	59
Louth	298	7
Grantham	297 majority	
Villages		
Grimsby	Carried	
Beamsville	100	20
Towns		
Oakville	268	37
Burlington	Carried	
Cities		
Hamilton	3192	3626
St. Catharines	1066	401

Welland-Port Colborne-Bridgeburg

Townships	For	Against
Crowland	191	80
Humberstone	339	91
Bertie	518	124
Villages		
Humberstone	146	4
Port Colborne	216	3
Fort Erie	78	8
Towns		
Welland	446	85
Bridgeburg	148	7

London and Port Stanley Earnings

A statement of the earnings of the London and Port Stanley Railway for the months of July, August, September and October, with comparative figures for the same period in 1915, was submitted to Sir Adam Beck and the members of the Ontario Hydro-electric Commission, on December 18, 1916. The statement shows that the net income increased $26,181.81, being $30,261.32, as against only $4,899.20 a year ago, when the line had just been electrified and taken over for municipal operation. Passenger earnings jumped from $49,241.75 to $77,755.28, while the gross mounted from $96,045.08 to $129,945.39. The operating charges increased $2,820.30 to $74,226.79.

Six new cars have been ordered by the Montreal and Southern Counties Railway Company from the Ottawa Car Company, consisting of three motor and three trailer cars, 55 feet long, with a seating capacity of 62 passengers. They will be equipped with four 50 horse power motors, improved Peter Smith heating and ventilation systems, smoking compartment and lavatory accommodation.

Personals

Mr. Chas. F. Gray, consulting electrical engineer, of Winnipeg, has been elected a member of the Winnipeg Board of Control. Mr. Gray is an Englishman, but was early associated in British Columbia with telephone construction. Later he was with the West Kootenay Power & Light Company as superintendent of transmission lines, and from 1900 to 1902 was engineer in charge of this plant. For the next two years he was chief high-tension operator on the Interborough Rapid Transit Company, of New York City. Mr. Gray then returned to England for two years and had charge of erection and was superintendent of operation of the Metropolitan District Underground Railroad Electrification, London. Returning to Canada he associated himself with the Canadian Westinghouse Company and had charge of the erection of this company's apparatus in some of the largest developments going forward at that period. When the city of Winnipeg decided to install a municipal plant at Point-du-Bois, Mr. Gray had charge of the installation of the Westinghouse apparatus at that point and also at the various substations, and operated the equipment until the system was turned over for commercial service to the city. Since 1912, Mr. Gray has been engaged in the consulting engineering field in Winnipeg.

Mr. Chas. F. Gray

Mr. W. H. Wadland has retired from the service of the Bell Telephone Company, of which he has been an official for 37 years. Mr. Wadland was the company's oldest Canadian official. Indeed, he was in the telephone business in Hamilton before the Bell Company. It was early in 1878 that Mr. Wadland, then a young telegraph operator, accepted the position of manager of the District Telegraph Company, a local concern started by Messrs. Hugh C. Baker and George Black for installing and operating electric call services. In November of the same year the call-boxes were removed and telephones were substituted for them, Mr. Wadland continuing as local manager. This was the first telephone exchange in Canada and the second in the world, the first one being opened in New Haven, Conn., a few months before. The pioneer Hamilton exchange was opened and for nearly two years conducted in the basement of the old building which formerly occupied the site of the present office building of the Bell Telephone Company on the south side of East Main Street. Early in 1880 the Bell Company took over the local telephone exchange and moved the office to the Hamilton Provident and Loan Building. About the same time Mr. Wadland relinquished the local managership to Mr. Kenneth J. Dunstan and accepted the position of superintendent of construction for the whole of Ontario, from Kingston in the east to Port Arthur in the west. Most of the thousands of miles of telephone line constructed in the province since then has been erected under his supervision. Several years ago the work was divided, and Mr. Wadland became division plant superintendent for the western division, embracing the territory between Oakville and Windsor. This is the position which he has now resigned, after 37 years of continuous service with the Bell Company and 39 years' connection with the telephone industry. Mr. Wadland will also be remembered by many central station men as one of the original members of the Canadian Electrical Association.

Mr. W. G. Murrin, who since April, 1913, has been acting as general superintendent of the British Columbia Electric Railway, with headquarters at Vancouver, is now assistant to general manager George Kidd. The promotion is well deserved, and will relieve the general manager of a portion of his heavy duties.

Mr. J. H. Martin has been appointed acting division plant superintendent, western division, of the Bell Telephone Company, with headquarters at Hamilton, Ont. Mr. Martin succeeds Mr. T. H. Wadland, who retires on account of ill-health.

Mr. C. E. Fortier has been appointed advertising manager of the Bell Telephone Company, with headquarters at Montreal.

Pro Patria

Word has just been received that Lieut. C. T. Bowring of the Canadian Machine Gun Company was killed in action on December 29th.. Lieut. Bowring was an engineer, and was employed with the State Elevator Company, Winnipeg, at the time of his enlistment in 1914.

Word has been received of the death at Salonika of Lieutenant Ronald Hayward, son of Mr. R. F. Hayward, general manager of the Western Canada Power Company, Vancouver, B.C. Lieut. Hayward, who was killed in action, joined the Royal Horse Artillery in England.

Lance-Sergeant Comrie S. Snowden, killed in action on December 12, was, prior to the war, an electrical contractor in Winnipeg. At the front he was a brigade wirer, engaged in fixing up the barbed wire entanglements in front of the first-line trenches. He enlisted in Montreal, where he was born 33 years ago.

The fine record of Sergt. J. H. Murray, R.E., D.C.M., formerly electrical engineer at Brunette Sawmills, New Westminster, who was killed on November 4 "somewhere in France," should serve as an inspiration to all who are allowing some petty hindrance to keep them from serving their country in its hour of need. At the outbreak of hostilities Sergt. Murray, who had previously served in the Imperial Army, sought to enlist in the R.A.M.C., but was refused on account of varicose veins. Not discouraged, he proceeded to England at his own expense, underwent an operation, and on recovery he enlisted in the Royal Naval Division and saw service at the Dardanelles as sapper and despatch rider. He won the Distinguished Service medal, receiving wounds which caused his transfer to Malta for treatment. When again ready for duty he was sent to France, where he joined the Royal Engineers, in which branch he won promotion. Sergt. Murray was a Scotchman, hailing from Alloa, and was unmarried.

The Dealer and Contractor

The Story of Why One Contractor Didn't Bid—Who Should Pay the Cost of Expensive Competition? It Falls on the General Consumer in the End.

The following interesting piece of fiction, true enough to life, however, is adapted from an article in the last issue of the National Electrical Contractor. It indicates the folly of the course of too many electrical contractors of bidding with the object of landing a job rather than with the object of landing a profit if they get the job. Many a good contractor in the towns and cities throughout Canada has learned from experience the uselessness of bidding under such conditions, and have taken the attitude of Jack Martin that, if business cannot be done on a paying, satisfactory basis, he would rather not do it at all. Such men gain their reputation through excellent workmanship, rather than by low prices—a much more solid foundation upon which to build a permanent enterprise.

The Gem City High School Building contract was to be let on the fifteenth of June. It was to be a $200,000 building, with all the refinements of any school of the same class.

Hadn't the Building Committee visited all of the recently erected high schools in the larger nearby cities, and hadn't they secured the services of an architect, who was recognized as one of the best in the country in this particular line of work, at a little greater cost, perhaps, than they could have procured the services of others?

Bids were to be opened by the architect and the entire board, and all contracts were to be let the same day; general building, plumbing, heating, wiring, painting, etc., etc.

Jack lived in Gem City. He was a wiring and lighting contractor. Jack enjoyed an excellent reputation as a very capable contractor, having equipped some of the best and most pretentious buildings in the community. Everybody knew Jack Martin and knew that, if he installed the wiring and lighting, the work would be well done.

In fact, two members of the Building Committee voiced it as their opinion, that the wiring and lighting should be let to Jack on a commission basis. That is, pay him the cost of material and labor, plus a reasonable profit. Most of the members, however, objected to any such arrangement on the grounds that it was to the interest of the taxpayers to procure just as much competition as they could possibly get. In fact, they didn't know but that it might be illegal to let the contract except on a competitive bidding basis. Of course, most of them, including the architect, would have liked to see Jack get the work.

Arthur Carson, one of the members, who was in favor of giving Jack the work, felt that while the other members and the architect might be right so far as public opinion or precedent was concerned, he couldn't help but remember some of the trouble the board had experienced a year ago, when the lowest bidder was given the wiring on the Garfield Grade School.

"Didn't the contractor go broke?" asked Mr. Carson. "Didn't the School Board have to resort to the bonding company for completion of the contract? Didn't they have several liens filed by sub-contractors and others? Weren't there several lawsuits for their attorney to look after? Wasn't the completion of the building delayed for almost a year? How much did it cost the board? Wasn't the cost far greater than if Jack had been given the job, even if his bid was $700 high, not saying anything about the additional time spent by every member of the board? And have we as good a plant as if Mr. Martin had put it in? No! You will all agree that we have not."

"But," said Mr. Adbury, the attorney member of the board, "that depends upon the architect to a great extent; and not only that, but you should never have let the contract to a man like that in the first place."

Price the Only Consideration?

"Agreed," said Mr. Jones, "but only when human nature has developed to a point where 'foresight is better than hindsight.' What could the architect have done about it? Didn't we get a bond? Could we have told this man that he couldn't bid because he was unreliable? If we had, we would undoubtedly have had to prove it; and, from my observation, libel suits are about as expensive as the trouble we had. No, siree! We may have the same trouble again, and we may not; but I claim that if we select the contractor, only because he is the lowest bidder and without considering anything else, we are more liable to have the same trouble again, than if we consider the man's qualifications as well as his price, and so long as we are paying the bills, our opinion should determine it."

"I say so, too," chipped in Mr. Carson. "There's only one condition upon which I will consent to 'wild' competition, and that is—that we may select our contractors, not because their bids are the lowest, or because they can give guarantees and bonds, or because they have done work all over the country. No, sir! I'll select my contractors because I know they are right. That's what I'd do on my own building; and so long as I know now who I'd select, if there is not too much difference in price, I'll not waste the other contractors' time in figuring. It'll cost them too much in time and money."

Mr. Carson resigned from the board.

"There's no place for such a man on this committee," he said. "Of course, no school board could think of awarding a $5,000 wiring and lighting contract without competition. What would the public say? Graft! Graft! That's what they would surely say.

"I'm in sympathy with all of Mr. Carson's statements," remarked the architect. "If I could act as my judgment, based upon experience, dictates, or if I were acting for myself as an individual, I think I'd feel and act as Mr. Carson does, but existing conditions really prevent it. While I feel that the wiring and lighting contract is really worth $5,000, it's a 'cinch,' from my experience, that if plenty of competition is had, there will be some bid at least $500 less and perhaps $1,000. There always is; and the more bidders there are, the more money the School Board is likely to save

This applies to all contracts; and so long as the contractors are willing to compete, haven't we the right or aren't we justified in taking advantage of it?"

Mr. Carson resigned because, while he didn't blame the board, he couldn't help but feel, as he expressed it, that "there was something rotten in Denmark." Who would lose the $1,000 that the board saved—if they saved it?

Of course, they hadn't saved the $700 on the Garfield School job. He knew that. In his opinion it had cost them $700 more than it would if Jack Martin had been given the job.

He decided to call upon his friend Jack Martin, the contractor, the next day to see if he could throw any light on a condition of affairs such as, in his opinion, existed in the contracting business.

He told Jack of his experience, and Jack laughed, although he said he was very sorry, if he was in any way the cause of Mr. Carson's dissention from the board.

"No, Jack, there wasn't any dissention," said Mr. Carson, "but I just can't get on to the 'dope.' Jack, do you think you have any show of getting the wiring and lighting? You know, it's going to be let on the fifteenth."

"No, I don't think I'll have any chance," said Jack, smiling; "because I'm not going to bid."

"Is that so? I'm sorry," said Mr. Carson, sincerely, "I thought you bid on everything, and especially on so important a job as this. What's the reason?"

"Well, Mr. Carson, " replied Jack, "I see you're more interested in this matter than anybody I ever knew, except, of course, the men who are engaged in the contracting business. They are always complaining about 'the rotten system,' as they call it, 'of bidding yourself to ruin.' If you had ever paid any attention to the business mortality in the contracting business; if you knew how few bidding contractors ever made a financial success; if you knew how few have any financial or credit rating, as compared with the number in business and the great volume of business they do, you would know that you have 'hit the nail on the head' when you say, 'There's something rotten in Denmark.' Why, they say that 84 per cent. of the wiring and lighting contractors are financial failures."

"How is it, then, Jack," Mr. Carson asked his friend, "that you have made a success of it? It seems to me that you have done very well."

"Well, Mr. Carson," said Jack, still smiling, "I haven't been what I call a 'bidding contractor' for ten years. It is true that I bid quite frequently, but only when I think there's more than an even chance that I'll get the contract, even though my bid is high. Most of my work comes without competition, and I never bid on public work any more, when I know that the job is going to be let to the lowest bidder, regardless of anything else. Mr. Carson, this bidding business is the biggest gamble in the world. Talk about horse racing, poker, faro, or any other form of gambling—they are tame in comparison. How do I figure it out? Well, just like this: You remember the Garfield School? Sure, you were on the Building Committee. Of course, the Garfield School was not as large as this new high school. Well, I bid on the job for three reasons:

"First—I thought I might be given a preference in the price, because I was a local man and my qualifications were known to every member of the board.

Second—I thought that because I was locally situated I had many advantages that an outsider would not have.

Third, and the principal reason—I wanted to make a demonstration to my organization, as I had for many years been studying this matter from an economic standpoint.

Going After the Contract Systematically

"I went after the job systematically. In the first place, I secured the services of a very good special engineer and estimator. Together we carefully estimated every bit of material and every bit of labor that we thought would be necessary to comply strictly with the plans and specifications and to provide a good job. We both decided that $3,000 would be a fair bid, about as low as any contractor should bid.

"However, that was just a starter. I didn't let this estimate influence me. I merely set it to one side, not advising my employees about it. Then I told them to get busy; and I want to say right here, by own estimator is about as good as they make 'em.

"At the outset I told my organization to keep a record of every cent expended upon figuring this work. It was four days before my man laid his estimate on my desk with his notation of the amount that he thought we should bid. It read $3,310, or only $310 higher than mine and my special engineer's estimate.

"How much gross profit will there be in this job for our organization if we get it?" I asked my estimator. 'Well,' he said, 'after we pay our overhead expenses there ought to be about $300, or about ten per cent. if we don't have too much hard luck.'

"How much has it cost you to figure the job?" I asked him. 'Well,' he said again, 'counting your time and every bit of expense we have gone to in the last four days on this job, including the regular overhead expense, it has cost our organization exactly $61 so far.'

"'All right,' I said, 'keep a record of that.' Then I got busy again. I personally went over every item, checking our office estimate with my special engineer's estimate. Wherever I found any discrepancies I checked them up, made investigation, got the very best prices I could get from manufacturers, and so on.

Then I decided to cut down our profit to $200. I did this because I felt reasonably sure I could not lose anything after the careful checking I had done. Then I looked over my bid. It read $2,700. By this time it had cost us $111.10 to figure the job. I made a note of these items, as I wanted to teach myself and my organization a little lesson. You already know how we came out."

Jack Teaches a Lesson

"You'll perhaps remember that the low bid was $2,600. I was $100 high and lost the job. The highest bid was about $3,000, if I remember right; and there were sixteen bidders.

I had one chance in sixteen, provided all bidders had figured as carefully as I and had made no mistakes; but your architect was right when he remarked to you one day that there is hardly a chance if you get enough bidders, but that some of them will leave out something or make some error. With this fact acknowledged I concluded that I had only one chance in twenty instead of one in sixteen.

Then, of course, there are a lot of contractors who figure that they can afford to take a bigger chance or a smaller profit just to get started in a certain community, or as an advertisement or for a thousand one foolish reasons. In fact, I have known contractors many times to take jobs below their costs just in spite or because they wanted to 'show a competitor a trick or two.' So my chances dropped to about one in thirty instead of one in twenty.

Then, in considering the matter a little further, I thought about the many items on the plans and specifications that weren't exactly clear. They were as good and clear as any I ever saw, or as clear and specific, as any architect could possibly make them, but at that there were perhaps ten or fifteen places where we could have construed them one way or the other. That is, in doing the work we might have construed them to our advantage or to the owner's advantage, depending upon our point of view.

In fact, I don't believe specifications can ever be written for a job of this size that are not sufficiently flexible to be 'juggled' two or three hundred dollars one way or the other, depending upon the attitude the contractor holds towards his work.

My office rules, however, have always been to figure on the safe side; to figure upon doing the work right and furnishing the right material whenever there is any question, that the job must be right when it is completed.

Then I wonder how many contractors would take this view or take their responsibilities so seriously. Wouldn't there be some of them that would take chances on getting extras or saving a little here and there, or 'skinning the job,' as it is sometimes called.

If I had invested less in figuring and my price had been higher, my chances for getting the job would have been smaller. If my price had been lower I would have been taking a bigger gamble if I had been awarded the job.

Some of the bidders I know spent more than I did. But assuming that the other contractors didn't invest as much, I'll venture to say we averaged at least $75 each, or a total of $1,200. Assuming further that all contractors figured correctly, as nearly as possible, figured exactly as I did, upon doing a first class job in every respect, and exerted every possible effort to give the owner a good job at the lowest possible price. Who, then, received the benefit from this competition, which cost the bidders $1,200?"

"Why, Jack," exclaimed Mr. Carson, "the School Board did! Why shouldn't they pay for this competition? Now we are getting somewhere. But, on the other hand, doesn't the ultimate consumer pay all of these costs? Didn't your $111.10 go into your yearly overhead expenses, and don't you indirectly charge it to your customers?"

Who Pays for It?

"That's just the question I wanted you to ask, Mr. Carson. But from an economic standpoint and in all fairness, shouldn't that particular building have paid that particular overhead? Further than that, Mr. Carson, do you want to know who pays for this unreasonable competition? You do, Mr. Carson, so does Mr. Hamilton, Mr. Armstrong, and Mr. Adams; in fact, all of you men for whom I do work, year in and year out. You know I couldn't pay it without going broke. You pay for it, Mr. Carson. That's the injustice of it. I charged the $111.10 to overhead, and must charge it to you when I do your work.

Now, do you want me to figure on competitive work? Do you want me to figure on the High School, knowing what you do? Do you see the point? I can't properly or fairly serve you, if I do, and that's why I don't bid on public work."

"Ah, ha!" grinned Mr. Carson. I'm glad I left the Building Committee and the Board. My judgment and intuition told me there was something wrong, but I couldn't just see it."

"Now, Mr. Carson, that isn't all," said Jack. "When you ask me to do your work, you don't always give it to me 'right off the bat,' but at the same time, when you want competition, you don't ask sixteen men to figure. You usually ask only two or three. Why don't you get more competition? It pays sometimes."

"Well, Jack, you see, it's like this," and Carcon looked Jack squarely in the eye. "I rather like to have two or three figures sometimes, so that I may know the figures are right, or perhaps as a check. You see, I am frank and I confess to some extent a lack of confidence in you. Not in your honesty, but perhaps I think you or some of your employees might make a mistake. Anyway, I always feel like 'thirty cents,' because I let the other fellows figure and waste their time and money; although, on the other hand, I might give the work to them, if they were considerably lower than you. Price, of course, is one consideration, but there are others. I have always felt that this competitive bidding was a very unsatisfactory proposition. While I don't get as much competition as I could, if I weren't so considerate, I feel that I'm getting all I have the nerve to ask for. If the job isn't very large I don't ask for competition."

"Yes, Mr. Carson, and because of that you are paying for the other fellow's competition when he gets all he possibly can."

"What's the solution, Jack?" asked Mr. Carson, rubbing the back of his neck. "Have you got it?"

Jack's Solution

"Yes, I believe I have," and Jack looked far more serious than he had at any time since Mr. Carson entered his office. "Let the man who gets the competition pay for it, and let him have all the competition he wants to pay for. When he pays for it he need feel under obligation to no one. He can let the contract to whomsoever he chooses.

"Not only that, Mr. Carson, but contractors wouldn't have to 'gamble' so much. Contracting would become a legitimate business proposition. I believe it would advance the character of the business.

Yes, and go further. It would be a blessing to manufacturers and jobbers of building materials, who now lose millions of dollars every year through unfortunate contractors—made financially irresponsible by unjust or improper practices. It would eventually benefit bonding companies and similar institutions, who now must 'gamble' upon these contractors as much as contractors themselves gamble.

"It would be more satisfactory to architects and owners. The conditions I have explained work just as much hardship upon the owner and his architect as upon the contractors. Ask architects if they think there's any part of their profession that gives them more concern than letting contracts; or ask yourself, you know."

Development of Portable Augers Much Used in Shipbuilding and Other Construction Work

By Mr. G. H. Blaickstone[*]

Only the man who has been reared within sight and sound of a shipyard—who has watched the development of a boat from the drafting board until she slid off the ways—can appreciate the vast saving of time and labor which has been accomplished in marine construction by portable electric tools. The writer has seen a shipyard swarming with men laboriously boring holes by means of an old style ship auger. He also saw what he believes was the first portable auger, drill and reamer combined ever used in marine work; this was in a yard on the Great Lakes. The device consisted of a series of sections which could be manipulated like a folding rule with belt-driven pulleys on each joint, the auger or other tool at one end and power furnished at the other end by a donkey engine. This unique device had a working radius of about thirty feet and would bore about twenty holes to the old hand auger's one.

The development of small electric motors made possible the application of the portable idea to the operation of drilling, reaming and grinding, but a wealth of experimenting was necessary to develop anything like a reliable tool which would stay on the job. In the case of our own line of portable electric tools we overcame the various defects, as they exhibited themselves, by a long series of experiments in our own shops and in hundreds of shops of our friends and customers. The primary difficulty to be overcome was that of producing a tool sturdy enough to withstand the rough usage to which this type of tool is subjected and yet have it electrically and mechanically effective. It is no reflection on the type of workman to be found in marine construction circles to say that they are not of the pink tea variety—their work demands that they are more or less strenuous in their physical and mental make-up and he who makes their tools must keep this fact in mind.

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[*] Vice President Van Dorn Electric Tool Co.

After having evolved a motor housing which would withstand rough usage without being unnecessarily heavy we turned our attention to the motor, and finally decided that a general purpose stock motor was not suitable for our purpose. We installed a motor department and worked out several motors all of a distinctive type, but wound for the different speeds which experimental and field work had established as being the most suitable for different kinds of work. In common with other manufacturers in this field we had been working to produce a tool which would not overheat and burn out the motor or fuse the switch contacts—the two commonest forms of trouble in portable electric tools. We eventually developed our present quick-acting make and break switch which operates as quickly when breaking as when making contact, and requires but a very slight touch on the control. This switch practically eliminates the sticking and fusing of switch contacts which formerly sent so many tools to the repair shop. Realizing the considerable degree of protection given to the motor by this switch, workmen would occasionally work a tool beyond its capacity for extended periods, which overload had a tendency to overheat the motor and endanger the windings. To offset this so far as was consistent with good working practice we increased the load capacity of the motor so that it would stand up under reasonable overloads. The motor temperature is kept down by a fan on the armature shaft. By thus producing a dependable tool we greatly enlarged its field of practical usefulness and gave the shipbuilder and shopman a reasonable assurance that his men would not be subjected to frequent lay-offs due to the failure of tools.

During this period of improvement in design of motor and switch other improvements were made one, a most important one, being in the design of the switch receptacle and housing. Formerly, when it was desired to renew or change a cable or conductor cord on electric tools, it practically was necessary to dissemble the tool. With our present form of connection in the switch box the removal of a cover exposes the connections and likewise renders it an easy matter to renew fuses. Gears were given a new ratio and cut, heat-treated and hardened, and the present design permits them to run in grease so that one application of grease for every 300 hours of duty is sufficient. The simple and efficient lubricating system and ball bearings assist materially in prolonging the life of the tools under severe heavy duty.

It is unnecessary to tell the man interested in ship construction and maintenance of the various ways whereby portable electric tools have become standard equipment in the yard and shop and aboard ship. It is sufficient to say that where there are holes up to 2 inches in diameter to be drilled or reamed or light grinding to be done, a type and size of portable electric tool adapted to the economical disposition of the work is indispensable. These tools can be had to work on any standard current, direct, alternating and universal, and their power efficiency remains practically the same irrespective of the working distance from the source of power. Unlike any other power driven tool their efficiency is the same, after being repaired properly, as it was when new, due to the fact that an electric appliance either works right or does not work at all. In our latest type of portable electric marine tool we have combined a drill, reamer and grinder which will work on direct current and when used with a bench stand and a post or wall stand practically constitutes a portable machine which can be taken to any part of the shop or ship when occasion requires it. What this means to shipbuilders and owners, especially during a breakdown when at sea, will best be appreciated by those who have been through this experience under old-time conditions. Dependable portable electric tools aboard ship often spell the difference between a profitable and a disastrous voyage. "Take heed ye men who go down to the sea in ships."

Electrical Contractors' Dinner

The electrical contractors of Toronto held their first get-together dinner of the year 1917 on Wednesday evening, January 3, at the Hotel Carls-Rite; there was a good attendance. After dinner the members were addressed by Mr. A. L. Boyd, of the Sheldon School of Business Science, who took as his subject "Personality"—that is, the importance of the personal element in business. More and more it is coming to be recognized that a man's success in the commercial field is largely a matter of his ability to win over his clients to his way of thinking, which, in the main, is a matter of personality. It is further recognized that in practically every phase of the business of this life we are simply salesmen, either of material or service, so that as a natural result the necessity for developing a pleasing personality is almost equally essential to all of us.

At the conclusion of the address the chairman, Mr. K. A. McIntyre, initiated a discussion on the two questions—"Are the talks of too general a nature for electrical contractors," and "Should organization of more definite character be attempted at the present time?" Mr. Nealon, Mr. Drury and Mr. Matthews spoke in favor of continuing the programme as at present, at least until such time as the members should have become thoroughly acquainted and until some more definite idea of the advantages to be gained by closer organization should be formulated.

Chairman McIntyre reports that the first tangible result of Mr. Boyd's energizing talk was an immediate development of the "action" side of the committee. Each member of this committee is calling on at least one electrical contractor per day during the three weeks which are intervening between the last and the next dinner, and splendid success is attending their efforts to bring in new members.

The next dinner will be held at the same place, Hotel Carls-Rite, on January 24, at the usual time, 7.30 p.m. The speaker for that evening will be announced at a later date.

House Wiring Campaign

Under the general direction of the Society for Electrical Development, a campaign, to be known as the "House-wiring Campaign," will be held throughout the United States from April 1 to May 15. A practical electrical contractor, Mr. G. M. Sanborn, of Indianapolis, has been appointed chairman of the campaign committee, which will have in charge this national movement for the wiring of homes throughout the United States. It is felt that this campaign will greatly increase business for electrical contractors without it being necessary to reduce the prices of installation below what will yield a fair profit. The advantages of an electrically wired house will be presented to the householder, rather than the cheapness of the installation. The movement thus has the co-operation of central stations, dealers and contractors, and doubtless will result in greatly increased business for all concerned.

Moving to Larger Quarters

The Victoria Electrical Supply Company, jobbers of electrical supplies, situated at 414 Yonge Street, Toronto, Ontario, will remove on or about February 1, 1917, to larger premises located at 157 King Street West, Toronto, which will bring them into the heart of the electrical district. There they will occupy a four-storey building, and will carry a complete line of standard electrical supplies, brass goods, fixture parts, and glassware. They will then be in a much better position to serve their customers, as they will have added facilities and more room.

Infinitely Safer

The following statistics are obtained from the report of Peter M. Hoffman, coroner of Cook County, in which Chicago is situated, and refer to the year 1915:

During the year there were 1,247 domestic tragic deaths in the home, that is to say deaths from other than natural causes. Of these deaths 228 were due to asphyxiation, 170 to burns and scalds, 161 to falls, 508 to suicides, of which 243 utilized gas, and one death by electrocution. The ratio of fatalities due to gas and electricity was thus 471 to 1.

Important Machinery Contracts

The S. Morgan Smith Company, York, Pa., have closed a contract with the Saguenay Light and Power Company, Chicoutimi, P.Q., for two turbines, each of 2,500 h.p., to be direct connected to generators, and one turbine of 175 h.p. for an exciter unit. The turbines will work under a head of 53 feet. They are to be fitted with Lombard oil pressure governors. The present plant consists of one generator turbine and one exciter turbine of the same capacity as the new equipment ordered.

Houston & Co. Accept Violet Ray Agency

Houston & Company, Limited, Winnipeg, Toronto and Regina, are now handling the Branston Violet Ray Generator for Western Canada, and report brisk business. This firm also handle a number of other saleable lines, including such well-known products as Delta electric hand lamps and lanterns, Allen soldering specialties, Frantz Premier cleaners, Amco semi-indirect fixtures and Canadian Beauty appliances.

Drumheller, Alta., Installing Power Plant

The Northwestern Engineering and Supply Company, Limited, have been granted a franchise by the town of Drumheller, Alberta, to supply light and power for the period of ten years. They also take over the pumping for the waterworks system. Nitrogen lamps will be used for the street lighting system which the town is planning on an extensive scale.

Norton Telephone Co. Absorbed

The Norton Telephone Company, Limited, have moved their offices and stock to 263 Adelaide Street West, Toronto, and became a department of the Canadian Independent Telephone Company. All the special lines handled by the Norton Telephone Company will be kept in stock by the new department of the Canadian Independent Telephone Company.

Their Fiftieth Anniversary

Charles Barber & Sons, manufacturers of hydraulic power equipment, Meaford, Ont., have issued a 1917 catalogue to mark their fiftieth year "in the design, manufacture and improvement of turbine waterwheels." The slogan of the company is "Conserve the water powers by using the Canadian Turbine Waterwheel."

The latest unit now being installed by the West Kootenay Power and Light Company at Bonnington Falls, near Nelson, will bring the generating capacity of the company up to 40,000 horse power.

Your Windows Are the Magnets of Trade

A well dressed, well lighted window draws the crowds.

The manager of a large store wanted to test the attractive power of well lighted windows, so he placed men behind screens to count the number of people who stopped to look at the windows with different lighting systems installed.

First the windows were lighted with exposed bare lamps in plain view and without reflectors. By actual count extending over four nights, this window attracted only 12 per cent. of the passersby.

The lighting equipment was changed. The lamps furnishing the light were placed above the display in a concealed position such as is used in more modern practice. All the light was thrown upon the display. None was reflected on the sidewalk or into the eyes of the spectators.

By actual count the window attracted 72 per cent. of the passersby. An increase of 500 per cent. due to increased attractive power of the lighting method.

Here is proof that correctly lighted windows will attract attention even on bright streets. Window displays that are properly lighted and attractively dressed arouse public attention and people learn to watch for the latest display. **They are the magnets of trade.**

Window displays are such valuable business-getters that you cannot afford to have them passed by unnoticed merely for the lack of attention-compelling illumination. With proper lighting every item stands out prominently—and shows off to the best advantage. The public gets the idea of values, which you wish to impress upon them. Their desire for possession is aroused—they buy.

You know just how it is yourselves—you buy your clothes at the store that can attract you more powerfully than all others.

The every-day business man usually has little time for "sight-seeing" in the daytime, but at night thousands of prospects stroll the streets and find no little interest in the well-dressed and lighted windows of merchandise.

The importance of good lighting applies even more forcibly to the feminine trade, for the fastidious woman instinctively avoids any store of dismal appearance or, contrarily, of flashy glitter.

This question of window lighting is one that might well be given immediate and earnest consideration, having in mind that every day's delay in getting a better illuminated window than your competitor costs you dollars in sales.

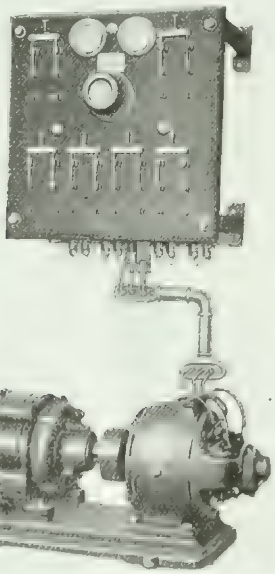
What is New in Electrical Equipment

A New Battery Charging Equipment

A complete new ignition, lighting and starting battery charging equipment, including motor-generator, and starting panel, has just been put on the market by the Canadian General Electric Company. The motor generator consists of a standard alternating or direct current motor mounted on the same base with and direct connected to a specially wound direct current generator. The motor is furnished for operation from 100, 220, 440 or 550 volt, 60 cycle, single, two or three phase, alternating current circuits or for operation on 230 volt, direct current circuits as desired. Starting boxes are furnished with all of the single phase alternating current motors and with the 230 volt direct current motors, but are not needed and hence not furnished with the two phase and three phase alternating current motors. Sets with 550 volt, direct current motors will be furnished where needed, but only on the basis of special quotations. Inquiry should state whether circuit is grounded trolley circuit or not, and give voltage regulation

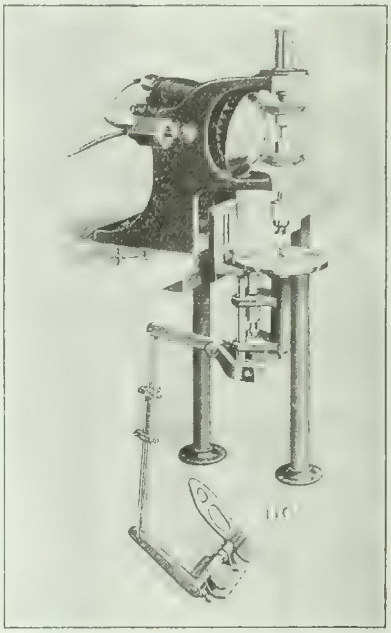
The generator is shunt wound for normal operation at from 30 to 37½ volts, direct current, 20 amp., 30 amp., 45 amp., and 60 amp. output. The field rheostat furnished is suitable for reducing the voltage to as low as 7 volts. The generators rated at 20 amperes will deliver 10 amperes at 7 volts, while the generators of higher current ratings will deliver 15 amperes at 7 volts.

The panel is black, marine finished slate, and is supplied with brackets for wall mounting. Each panel is equipped with a voltmeter arranged to read the voltage delivered by the generator, an ammeter arranged so that it can be used to read the current delivered to any of the charging circuits, a rheostat for controlling the voltage generated, and double pole, double throw switches fused back of panel, one switch for each charging circuit—1, 2, 3, 4 or 6 circuits being provided for as desired.



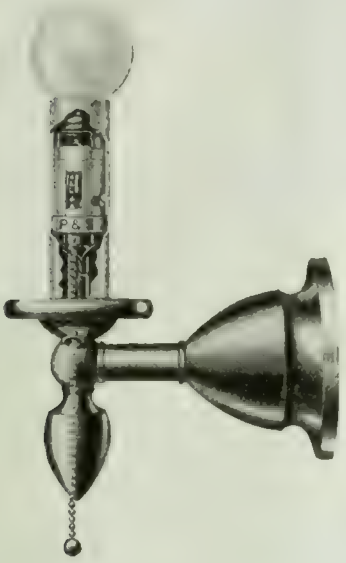
New Electric-Driven Tapping Machine.

A direct motor-driven tapping machine has recently been developed by the Anderson Die Machine Company. As shown by the illustration, the power is transmitted from the motor to the spindle through a spherical friction driving disc and two spindle friction wheels, one for driving the taps forward into the work and the other for reverse. The friction driving disc is mounted direct on the shaft of a Robbins & Myers motor, which has a capacity of 1/6 horse power at 1,750 revolutions per minute. The motor is pivoted in the frame of the machine on a line with the centre of the shaft which carries the friction driving disc. By merely tilting the motor various cutting and return speeds are obtained. If the speed is reduced in one direction it will be increased in the other. In this way a quick return speed is obtained to compensate for a slow cutting speed. Or if a quick cutting speed is used the return speed will be slower. The sum of the cutting and return speeds is always 2,000. The spindle is mounted in S.K.F. radial ball bearings, and a spring is provided at the upper end, which can be adjusted so as to balance the weight of the spindle and various parts related to it. The work-table is mounted on two-way rods, spaced far enough apart to give a rigid, easy movement. The table is operated by means of a foot-treadle. The column which supports the table is hollow, and can be filled with oil so the tap will dip in the oil when it goes through the work, lubricating the tap and washing off the chips.



Chain Pull Candle-Fixture Socket.

The modern tendency to combine two or more devices, thereby making a more compact unit, results in a material saving to the wireman in labor cost as well as in initial outlay. This applies to P. & S. 1215, the chain pull candle-fixture socket recently placed on the market by Pass & Seymour Inc., of Solvay, N.Y. It is no longer necessary to install a chain pull switch in the bottom of the candle stem, or a switch in the fixture body or canopy, as this device, being a combination of the socket and switch, presents at once the opportunity for individual control of the lamps on the chandelier, bracket, or pendant candle-fixture, as may be desired. The elimination of awkward and difficult splices in small cramped spaces is a point in favor of this device from the standpoint of standard wiring practice. The wiring is easily accomplished because the terminals are of generous size and readily accessible. The screws are large and of sufficient length to accommodate the wires, and the raceways for the wires are deep enough to prevent crowding or bulging of the fibre casing. This socket is designed especially to work smoothly in the standard fibre or glass candle sleeve, yet of sufficient diameter to fit snugly within the candle. All live parts of the device are concealed within the body, with the exception of the terminal plates, so that a short-circuit, from careless wiring, is out of the question. The nipple is seated deep in the body of the device, and affords a solid connection for the pipe and socket. It is fitted with the standard set screw, to prevent turning on the pipe. The chain may be easily removed, making it handy to refinish or to slip through the bobesche when assembling the fixture.



Trade Publications.

Condulets—A schedule in the form of a folder, issued by the Crouse-Hinds Company of Canada, explaining how standard or first-types of condulet bodies can be substituted with latest types of condulet bodies.

C. G. E. Publications—The Why of GE Circuit Breaker Efficiency; illustrated bulletin describing G-E circuit breakers. Cooking Comfort in the Kitchen; small pamphlet illustrating and describing type S G-E electric ranges.

Westinghouse publications—Self-contained vertical shaft a.c. generators; leaflet 3555-A, illustrating and describing this type of generator. A.c. motors for driving grinders; leaflet 3903, illustrating and describing the application of this type of motor. Automatic operation of induction feeder-voltage regulators; a comprehensive treatise on this subject, representing the latest developments. Electrical arc welding equipments; leaflet 3668-B; describing and illustrating arc welding equipment. Silk throwing industry in Northeastern Pennsylvania; describing machinery and methods in the textile industry. Automatic starters for squirrel cage induction motors; leaflet 1660, illustrating and describing remote starting equipment. Substations for mines; leaflet 3697; a discussion of motor generators and rotary converters for mining work; illustrated.

The city of Sherbrooke, having passed a resolution to build, under certain conditions, a transmission line—costing $50,000—from the Weedon power station of the Two Miles Falls Water Power Company, and to purchase power from the company, action was taken to restrain the city from proceeding with the work, and also from buying power. Mr. Justice Hutchinson granted an interim injunction, and in view of this it is understood that the city have decided not to proceed with the project, at least for the present

Growth of the Central Station

The growth of the central-station industry in the past decade has been little short of phenomenal, and the end is not yet. The success of a particular type or class of application is an advertisement and a visible example of the successful application of central-station service. New industries are constantly coming into being as potential users of this class of service, such as the electric heating and melting furnace, and old and already established industries, such as steel mills, office buildings and coal mines are increasingly finding it advisable to contract for such service, and the end is not yet. In approaching this end and in realizing its greatest fruits, the central-station management and the central-station employee have severally collective and individual responsibilities, the proper and efficient fulfilment of which will result in profit and satisfaction to all.

Volcano Develops 15,000 H. P.

In Italy the price of coal at present varies from $40 a ton at seaports to $50 in the interior. In central Tuscany near Volterra this economic pressure has resulted in the erection of a large electric plant operated by subterranean steam from a volcano. There are here numerous cracks in the ground, from which powerful jets of steam constantly spout high into the air. These are known as soffioni (blowers), and for many years boric acid and borax have been extracted from the steam

This steam is now used for generating power. According to Professor Luiggi, in Engineering, credit for this use of steam on a large scale is due Prince Ginori-Conti, who has been experimenting in this district since 1903. Holes from 12 to 20 inches in diameter were bored in the ground, and pipes were driven down to the source of the steam, which is under a stratum of hard rock 300 to 500 feet below the surface. The steam issues from these holes at pressures of two to three atmospheres and temperatures of 150 to 190 degs. C. New borings do not seem to affect the supply, so long as the distance apart of the holes is not less than 50 feet.

It was attempted to use the steam direct to drive a 40 h.p. steam engine, but the borax salts and the gases mixed with the steam, especially sulphurated hydrogen and traces of sulphuric acid, had a corrosive action on the metal parts of the engine. The difficulty was got around by applying the superheated volcanic steam to a boiler; that is, substituting it for fuel in an ordinary multi-tubular boiler in which steam was produced at a pressure of two atmospheres, then passed through a superheater where it was dried by volcanic-steam heat and was then used to drive a 300 h.p. condensing steam turbine, directly connected to a three-phase electric generator, which supplies the works and villages around about Larderello.

This plant proved so successful that, when the war broke out and prices of coal soared, Ginori-Conti decided to carry out the work on a large scale. Three 3,000 kw. turbo-generators were ordered, from the Tosi works of Legano, designed to operate with superheated steam at 1½ atmospheres, generated in specially constructed multitubular boilers having aluminum tubes for the better utilization of heat and better resistance against corrosive action of the volcanic steam. In the boiler the steam temperature was reduced from 180 degs. to about 120 degs. C., and borax was extracted from the exhaust.

One of the 3,000 kw. units has been at work since January, 1916, the second since April, and the third has very recently been put into service. The three-phase electric current is generated at 4,500 volts, 50 cycles, and stepped up to 36,000 volts for transmission to Florence, Leghorn, Volterra, Grosseto and other towns in Tuscany.

Current News and Notes

Alvinston, Ont.

The Brooke Municipal Telephone Company, Alvinston, Ont., will build a direct line between Watford and Inwood.

Cobalt, Ont.

The transmission line being extended by the Northern Ontario Light and Power Company, Cobalt, Ont., from that city to Kirkland Lake, is nearing completion. This line, which is 65 miles in length, was commenced last June and service lines to the Kirkland Lake Mines, which will be the largest users, will also be ready for use in the near future.

Fort William, Ont.

The Mahon Electric Company, Limited, Fort William, Ont., have obtained a charter.

Galt, Ont.

The hydro-electric commissioners of Galt, Ont., have decided to enlarge the Dickson Street sub-station by the addition of another storey and basement and an extension at one side of the building. This is made necessary by the constantly increasing demands of power users.

Greenfield Park, Que.

The town council of Greenfield Park, Que., have received tenders for the installation of an electric lighting system.

Hamilton, Ont.

The annual statement of the Hydro-electric Commission of Hamilton, Ont., for the year ending December 31, 1916, shows an increase in connected load from 19,946 h.p. to 24,136 h.p. Negotiations are being carried on with the Hydro-electric Power Commission of Ontario for a further supply of power to meet existing demands.

Manager E. I. Sifton, of the Hamilton Hydro Department, has recommended the installation of a reversible motor-generator and storage battery in the Hughson Street substation, so that, in case of line trouble, the waterworks could be operated or the city supplied with light.

Montreal, Que.

The Duncan Electrical Company, Limited, Montreal, Que., have obtained a charter.

The city of Verdun, P.Q., has received legislative authority to expend $250,000 on underground conduits.

Orillia, Ont.

The annual statement of the water, light and power commission of Orillia, Ont., shows an increase in connected load of from 1,524 h.p. to 2,607 h.p. during the year.

Port Hope, Ont.

The Hydro-electric Power Commission of Ontario will construct a power line in Hamilton township along the Cobourg Road for a distance of one mile, starting from the House of Refuge. This supply will serve seven farms with power and light immediately and will open up a means of introducing Hydro power to the entire township.

Preston, Ont.

The Preston Car & Coach Company, Preston, Ont., suffered loss [illegible]

Sherbrooke, Que.

The Southern Canada Power Company, Limited, are negotiating to take over the control of the Sherbrooke Railway and Power Company. The proposed [illegible] reorganization creating a 6 per cent. preferred issue, cumulative from January [illegible] Sherbrooke Railway and Power Company [illegible] the company have advised acceptance as the prospects for dividends are not bright.

St. Rose du Degele, Que.

La Compagnie d'Aqueduc de Sainte Rose du Degele, St. Rose du Degele, Que., has been formed for the purpose of constructing and exploiting a system of waterworks in that village and the purchase of water powers for the installation of an electric light plant to supply lighting in the parish of St. Rose du Degele and surrounding parishes. Capital stock, $20,000.

Toronto, Ont.

For having performed electrical work without a permit in contravention of the Hydro-electric Act a Toronto contractor was recently fined $30 and costs with the option of thirty days in jail.

At a meeting of the Toronto city council on January 8 it was decided to notify the Toronto Electric Light Company to remove their poles from the streets within thirty days.

The east end car barns of the Toronto Street Railway Company were recently destroyed by fire. The loss, with rolling stock, is estimated at $500,000. Plans are under way for for immediate re-building.

The Toronto Electric Light Company have discontinued their free lamp service to customers. To offset this change, rate reductions equivalent to the cost of supplying the lamps are contemplated.

The Ontario Hydro-electric Power Commission announce that measures to enforce greater economy in domestic and street lighting will be necessary to cope with the problem of supplying power to munition factories, unless arrangements can be made for a large and immediate addition to the present supply of power.

Vancouver, B.C.

It is rumored that the Great Northern Railway is considering plans for the electrification of their lines into Vancouver, as well as other lines in Washington. The work proposed will take three years and electric energy will be developed in the Hope Valley district.

Victoria, B.C.

Discovery of damage done to city water mains by electrolysis is causing City Engineer Rust of Victoria no little worry. Wherever the tracks are used as the return circuit for the current to the power house, damage from electrolysis, it is claimed, nearly always follows to gas and water mains in the vicinity. As these cases increase, there is no doubt that the city will have to adopt a definite policy on the matter. The question of collecting compensation rests upon proof by the municipality that the electric company has not taken all necessary preventive steps, and that is not an easy thing to do. The subject came up recently through a complaint of definite damage to city property at the corner of Bay Street and Government Street. It was alleged that the water mains in the vicinity had become pitted to the extent that there was [illegible] which flooded and damaged property.

Winnipeg, Man.

The Perkins Electric Company, Winnipeg, Man., have registered.

The Transcona Electric Railway Company, Winnipeg, Man., have made application for incorporation. Work will start in the spring and it is expected the line will be in operation by fall.

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What Capacity is Necessary for Residence Heating?

As the day of electric house-heating approaches, there is a well-intentioned but, we believe, mistaken effort being made to help the movement along by underestimating the capacity of heater required. In this way, of course, it is possible to inveigle the unwary layman, who does not know the difference between a watt and a lamp bulb, into believing that he can heat his house with an amount of current very much smaller than it actually works out when the installation is placed in operation. The result is a dissatisfied customer who throws out his electric heater and—worst of all advertisements—tells his friends and neighbors that electric-heating is simply a gentlemanly expression for freezing to death.

It is worse than useless to do other than meet the facts of electric house-heating fairly and squarely, quote accurate figures of consumption and cost and trust to the satisfactory results that are certain to follow to make friends for the movement.

In this connection we have time and again warned our readers against looking for miracles. The fact is that one watt per cubic foot is not a sufficient capacity to keep a room warm in anything but the mildest days of our winter climate. In weather that approaches anywhere near to zero, two to two and one-half watts per cubic foot are necessary, and if one is to guard against the kind of weather that ruled in Canada early in January of this year, it will be necessary to install 3 to 3½ watts per cubic foot.

This is not nearly so bad as it sounds at first hearing, however, because the average requirement is much less than the maximum and the cost of operation depends, of course, on the average. Do not let us forget, however, that the severest test of electric or any other kind of heating comes in the coldest weather, and if it does not stand up to that test it is discarded—rightly, we believe. The error, therefore, in most of our installations to date is not in estimating the cost of operation, but in underestimating the necessary capacity of the heating equipment.

We do not buy a coal furnace for September temperatures. Instead we are content to operate a No. 6 inefficiently for six months of the year that we may have it operating efficiently and have our house comfortable during one—the coldest—month of the year. We must also install electric heaters on the same basis, but we have the advantage with the electric—and should make the most of it in argument—that it operates equally efficiently at all temperatures.

In conclusion, it may be interesting to quote a paragraph from a letter just received from Professor Osborn, of Seattle, whose article on heating tests we reproduced in our last issue, and in which he says: "Even in our mild climate—10 degs. above being the coldest—I have found no satisfactory installation in Seattle on less than two watts per cubic foot."

If this is true where the temperature does not fall below 10 degs. above, is it not the height of folly on our part to tell unsuspecting electric prospects that anything less than 3 watts per cubic foot will keep them warm in zero or lower weather? Are we not injuring the cause of electric heating if we sidetrack the facts? What we need badly is a few experimental installations which could determine definitely, not only the capacity but also the actual current consumption and cost. We shall never get anywhere either by guessing or misrepresentation.

Cordial Relations

The letter reproduced below was sent out by the Electrical Department of the city of Saskatoon with the first bill issued to each customer in the New Year. It indicates a very satisfactory, even happy, state of domestic affairs within that typical go-ahead western centre, the cause for which we have not far to seek if we may judge by the very courteous and earnest-desire-to-serve sentiments of this particular example of the communications that pass between the Electrical Department of that city and its customers. Nothing assists more in making any public utility a success financially or otherwise than the "friendly attitude of the citizens" and the "cordial relations" between the citizens and the staff. It may be, of course, that the citizens are less critical and more cordial in Saskatoon than in other cities, but it is far more likely that this relationship is the result of a superior organization within the Electrical Department itself:—

Office of the City Electrical Engineer.
Saskatoon, January 1st, 1917.

Dear Sir or Madam:—

With this, your first bill covering current consumed in the new year, the Electrical Department desires to convey to you, sincere thanks for your co-operation during the past year. The present splendid position of your Electrical Department is due, in no small measure, to your co-operation.

The year just past has proved to be the most profitable in the history of the department, notwithstanding the fact that rates are lower than ever before. This satisfactory condition of affairs is due to the increasing demand for electricity for lighting, cooking, heating, and other domestic and commercial purposes.

The accounts, too, are in better condition than they have ever been before. This is due, entirely, to the encouraging response which you have made to our requests for prompt payment.

We assure you that the friendly attitude of the citizens towards the electrical Department, and the cordial relations which exist between the citizens and the staff, are very encouraging and very much appreciated, and we shall endeavor, during the coming year, to merit a continuance of the same. We question very much if a better condition of affairs exists in any other city where the electricity supply is controlled by the citizens.

We would ask you, therefore, in order that these very satisfactory conditions may continue to exist in Saskatoon, that you make it one of your New Year's Resolutions, to use more electricity, especially for domestic purposes, such as cooking, heating, washing, ironing, etc.; also that you resolve, during 1917, to take advantage of your ten per cent. discount every month.

With best wishes for a very Happy and Prosperous New Year.

Yours very truly,
E. HANSON,
City Electrical Engineer.

The Joint Committee of Technical Organizations (Ontario Branch) is sending out letters to some 2,000 technical men, explaining in detail the organization and the aims of the committee. Every technical man in the Province of Ontario who does not receive such a letter during the week ending Feb. 3 is requested to communicate immediately with the secretary, Room 910, Excelsior Life Building, Toronto.

Southern Canada Power Co.

The Southern Canada Power Company, with its head office in Montreal, is gradually becoming a very important factor in the lighting and power situation in the Eastern Townships of the Province of Quebec. Last year was one of expansion, which is likely to be more pronounced in the future when the six water powers, with a total head of 300 feet, and an ultimate capacity of about 150,000 h.p., are developed. The demand for power for industrial purposes is growing at a rapid rate, stimulated by munition orders, and there is reason to believe that after the cessation of hostilities, there will be the same need, as industries are continually increasing in that part of the province. The company have just put into operation the new transmission line at Sherbrooke under an agreement with the city. The most important feature is the absorption of the Sherbrooke Railway and Power Company, the financial interests in both undertakings being largely the same.

According to the president's report at the annual meeting recently held, contracts have been made with the Shawinigan Water & Power Company for the sale to it of two blocks of power out of the first and second developments. The electric plants at St. Johns, St. Hyacinthe and Drummondville have been modernized and placed in the highest state of efficiency, and the service has been considerably extended. High tension transmission lines have been constructed from Chambly to St. Hilaire and Beloeil and thence to St. Hyacinthe. The franchises of the company have been supplemented by contracts with St. Hyacinthe, Beloeil, St. Hilaire, St. Mathias and St. Hugues, which are now operating. The municipal plants at Drummondville and Iberville have been purchased and [illegible] over, along with contracts for municipal street lighting and pumping.

Electro-Chemical Processes Applicable to Many Manufactures

In estimating the value of Canada's hydraulic resources and their importance with reference to future industrial development, the extent to which electro-chemical processes have entered into some phases, at least, of nearly every branch of our industrial life is not generally appreciated.

A small beginning in electro-plating, two generations ago, has developed until the great bulk of the copper output of the world is electrolytically refined. The electrolysis of common salt is the basis of the electrolytic alkali industry, the products of which are caustic soda, metallic sodium, chlorates, and hypochlorites. The electric furnace has created a host of new industries, producing chiefly abrasives, graphite, silicon, ferro-alloys, refined steel, phosphorus and calcium carbide. It has also been tested experimentally as a competitor of the combustion furnace in the metallurgy of many metals.

Used as an electrolytic furnace, we have the very important application to the production of aluminum. The industrial use of electric discharges through gases is still in its infancy, but we have ozone and nitric acid among the products, the former used for sterilization, and the latter as a basis for fertilizers and explosives.

Every one of these industries consumes large quantities of energy. Whereas the refining of lead requires only 120 kw.h. per ton, we have consumptions as high as 4,000 kw.h. per ton for other metals. The aluminum furnace requires 25,000 kw.h. per ton of product.

The electro-chemical industries have grown to be of great value to countries which possess good opportunities in water power resources, as they have a fundamental interest in the development of cheap power.—L. G. D. in Conservation.

More Electricity for Alberta

If we are to believe the present indications, Edmonton is destined to be the centre of one of the large hydro-electric systems of the Dominion. Seventy miles southwest of Edmonton on the North Saskatchewan River the Edmonton Power Company started, on the first of January, clearing the ground and getting the excavation ready for the big dam which they propose to build at that point. They will develop the North Saskatchewan to its full capacity and create at the same time a pondage of some sixty square miles, which will give them a plant capacity of 55,000 horse power. It is estimated that the construction of this power scheme will take several years before it is put in operation, and will cost over $5,000,000.

In connection with this power development a contract has been let to the firm of Fairchild, Jones and Taylor, for the location and construction of a railroad from Edmonton to the dam site. The work of locating the railroad has already started, and it is the intention to proceed with the construction of this railroad with great energy, so as to facilitate the transportation of the material necessary for the erection of the dam and power house.

In the line of smaller undertakings in the Province of Alberta, Hardisty turned on electric light for the first time on December 15, 1916, and efforts are being made to extend the service throughout the town during the winter. Wainwright will have light early in the summer. The contractor had hoped to have the power plant and distribution system ready for the first of the year, but as the franchise was not ratified by the ratepayers until the middle of October, the contractor found himself unable to get the necessary material on the ground before the freeze-up, so that work will not start now before May. At Drumheller the coal company is reported as contemplating the installation of an electric plant to operate its collieries, and give electric light to the village.

Industrial Heating for Shoe Factories

By Davis M. DeBard

Electricity has replaced the high pressure steam boiler for industrial heating purposes in many shoe factories. After three years of continuous effort the Brockton Edison Co. succeeded in substituting electrically heated machines for all machines requiring steam heat in one of the shoe factories in Brockton, and the results have been most gratifying. The factory referred to has an output of 700 pairs per day and the shoes manufactured are men's Goodyear welt shoes, retailing from $4.00 to $6.00 per pair.

The machines electrically heated, with their connected loads, are as follows:

Number	Machines	Kw. each	Total kw
2	Goodyear Stitchers	.62	1.24
2	Goodyear welters	.48	.96
1	Bobbin winder		.10
2	Pulling over machines	1.47	2.94
4	Box toe steamers	.75	3.00
1	Bottom drier		2.28
1	Bottom filler		.55
1	Gem insole machine		2.86
	Total connected load		13.93

A watt meter has been installed on each group of machines, and below is given a record for July, August and September of shoes made and kilowatt hours for each operation:

July

Shoes manufactured 14,821 pairs
Total kw.h. for heating machines 2,570 kw.h.

Number	Machines	kw.h.	kw.h. per 100 pairs
2	Goodyear stitchers	312	2.1
2	Goodyear welters	217	1.5
2	Pulling over machines	534	3.6
4	Box toe steamers	620	4.2
1	Bottom drier	640	4.3
1	Bottom filler	171	1.2
1	Gem insole machine	76	.5
			17.4

August

Shoes manufactured 16,998 pairs
Total kw.h. for heating machines 2,965 kw.h.

Number	Machines	kw.h.	kw.h. per 100 pairs
2	Goodyear stitchers	369	2.1
2	Goodyear welters	232	1.4
2	Pulling over machines	616	3.6
4	Box toe steamers	724	4.2
1	Bottom dryer	610	3.7
1	Bottom drier	741	4.3
1	Bottom filler	211	1.2
1	Gem insole machine	72	.4
			17.2

September

Shoes manufactured 16,468 pairs
Total kw.h. for heating machines 2,841 kw.h.

Number	Machines	kw.h.	kw.h. per 100 pairs
2	Goodyear stitchers	341	2.1
2	Goodyear welters	240	1.4
2	Pulling over machines	615	3.7
4	Box toe steamers	707	4.3
1	Bottom dryer	610	3.7
1	Bottom filler	179	1.1
1	Gem insole machine	149	.9
			17.2

No boiler in operation for steam.

There are also a few other machines in this factory, as in every factory, heated by gas. It is fair to assume that these machines, if electrified, would require 2.8 kilowatt hours per 100 pairs, making the total for industrial heating 20 kw.h. per 100 pairs. It is unnecessary, however, to devote our efforts at present to electrifying these machines, because we believe that after the steam machines are electrified these will surely follow. With current at two cents per kw.h. the cost for industrial heat per 100 pairs would be forty cents.

In going over the kw.h. consumed, given above, it is interesting to note how uniform the current consumption has been, and how other conditions have affected the consumption of the bottom drier—July and August having been rainy and damp, the consumption was higher than in September, when the weather was dry and clear, with practically the same output.

Heretofore one of our greatest problems in interesting the shoe manufacturer in electric service for power, has been the machine heating problem. But now being able to tell him that electrically heated machines can be substituted for the steam heated machines, he becomes interested because:

First—he is relieved of the trouble and large expense in operating a high pressure boiler, requiring a licensed operator, who in Massachusetts is not permitted to leave the boiler room for more than fifteen minutes at a time.

Second—He can apply heat to any one or more machines when and where needed.

Third—He has perfect control of heat.

Fourth—His costs are proportional to his output.

Fifth—His costs are less than by the high pressure steam method.

In collecting data from a number of shoe manufacturers purchasing light and power from us, but operating high pressure boilers for industrial heating, we find that during the months of June, July and August, when no factory heating was required, the coal used per 100 pairs of shoes made, runs between 90 and 191 pounds, the average being about 125 pounds per 100 pairs made.

Take the factory using 90 pounds per 100 pairs for industrial purposes, and analyze costs for one year:

Shoes manufactured one year	pairs	304,000
Coal for industrial heating and factory heating, 307 tons	pounds	687,000
Water evaporated	cubic ft.	76,400
Engineer, at $24 per week		$1,248.00
Coal, per ton		5.50
Water, per 100 cubic feet		1.00

On a basis of 90 pounds per 100 pairs for industrial heat, 273,600 pounds of coal would be required, while 414,080 pounds or 185 tons would remain for factory heating.

Comparative Heating Costs

Operating Costs—High Pressure Boiler and Steam for Industrial Purposes

Coal, 307 tons at $5.50	$1,688.50
Water, 76,400 cubic feet at $1.00 per M.	76.40
Engineer, $24.00 a week	1,248.00
	$3,012.90

Operating Costs—Low Pressure Boiler and Electricity for Industrial Heating Purposes

Coal, 185 tons at $5.50	$1,017.25
Water, 46,000 cubic feet at $1.00 per M.	46.00
Labor for heating 30 weeks at $10.00	300.00
52,288 kw.h. at two cents per kw.h.	1,045.76
	$2,409.01
Makes saving to shoe factory per year	603.89
Per cent. saving—25 per cent.	

In 1907 the company started a power campaign, and by establishing a fair power rate and continually soliciting this class of business, particularly the shoe business, which is Brockton's greatest industry, it can now safely say that seventy per cent. of the shoes made in the district by the company are made on electric power, and now that the heating problem has been eliminated, we hope to make it ninety per cent. In the district served by the company's lines, 25,000,000 pairs of shoes were made during the year 1915.

We find that the owner of the shoe factory is like the man from Missouri, he wants to be shown that electrical industrial heating is a success. We have demonstrated that it is, that the operators of the machines like it, that the cost is less and that the very best results are obtained.

If the central stations having shoe factories in their district can get one factory equipped, give it newspaper publicity, and do as we have done in personally conducting a number of shoe factory superintendents and owners through the electrified factory, it will do more to secure the majority of this excellent business within the next five years than any other method.

Notes on Magnetic Testing

By E. V. Pannell, Assoc. Mem. I.E.E.

The methods adopted by a large electrical works for the testing of the iron and steel used in their machines are of particular interest, because, owing to the quantity of material put through, the testing has to be carried out with considerable speed and at the same time with a reasonable degree (2 to 3 per cent.) of accuracy. The economy and efficiency of electric generators and motors is very closely dependent upon the quality of iron employed in the magnetic circuits. Copper is subject to very little variation, but iron and steel are liable to be subject to so much variation in respect of permeability, hysteresis, and eddy currents that the work done in the iron-testing laboratory is among the most important testing in the factory.

Materials passing through the test room include sheet iron of two or three standard thicknesses for armature punchings, sheet steel of about .065 in. thick for rotating pole cores, special low core-loss steel sheets for transformers and alternators, and cast steel for machine yokes, casings, etc. Practically all of these are tested for permeability, whilst in addition those designed for use under alternating magnetization must be tried out for hysteresis, resistance, and total core-loss. By a permeability test is meant obtaining the simultaneous values of B and H for the specimen; also the corresponding values in inch measure. For this test the specimen is placed in a cast steel yoke, magnetized, and throws taken on a ballistic galvanometer with different degrees of magnetization. The ballistic is calibrated from a standard air-core solenoid of known characteristics. The general layout is shown in Fig. 1, whilst Fig. 2 shows the simple type of yoke permeameter employed. The most important part of the equipment is the standard solenoid.

This is wound around a hardwood core and fixed upon the wall or ceiling in a perpendicular direction, as far as possible from any structural steelwork. Particulars of the winding employed in the solenoid under consideration are: Primary, 1,449 turns; resistance, 25.33 ohms at 17 degrees C.; secondardy, 617 turns; resistance, 14.91 ohms at 17 degrees C. Now, from the fundamental equation the flux density in air equals the intensity of magnetization (H) $4\pi/10 \times IS/L$, where IS is the ampere-turns and L the length of core. Then the total flux through the core with one ampere is $4\pi/10 \times 1{,}449 \times 1 \times 20.62/75 = 501$. This is multiplied up 617 times by the turns on the secondary, so that the total lines linked with the circuit to which the ballistic will respond is 501×617.

Ballistic Galvanometer.

The moving coil mirror type is used, the instrument having a period of 15 seconds. At the same time, to secure speed in testing, means are afforded to damp the motion rapidly, and the combination of resistances and dry cell shown in Fig. 1 is most effective. The sensitiveness of the galvanometer is adjusted by means of resistance in series, and, of course, if desirable, the scale can be so inscribed and the instrument adjusted that it reads direct in B. In general, it is better to find the galvanometer constant K in terms of B per scale division. We have seen that the standard solenoid gives 501×617 as the total flux on reversal of one ampere. This will produce a throw G on the ballistic scale. Now it is necessary to find the relation between this deflection and the reading produced when the solenoid is substituted by the test yoke. The latter has a secondary of 100 turns, but the area of its iron sample will be different for every test, consequently the nearest expression we can deduce for the B (lines per square centimetre) per scale division is $501 \times 617/G \times 100 \times a$, where a is the area of the test piece. This expression is the galvanometer constant K.

Testing Yoke.

The yoke is of high permeability mild steel, made up for convenience of two parts joined horizontally. This in no way affects the reluctance of the magnetic circuit, and enables the contact seatings at the end of the specimen to be readily milled out. Separate end chucks are provided for square and round samples of sheet or castings. The sheet samples are punched 8 in. × $\frac{3}{8}$ in. and about 10 strips of .014 in. or 6 pieces of .02 in. give the requisite area, being clamped into the yoke by brass wedges driven into each end. The winding of the test yoke is as follows: Primary, 407 turns; resistance, 625 ohms at 17 degrees C.; secondary, 100 turns;

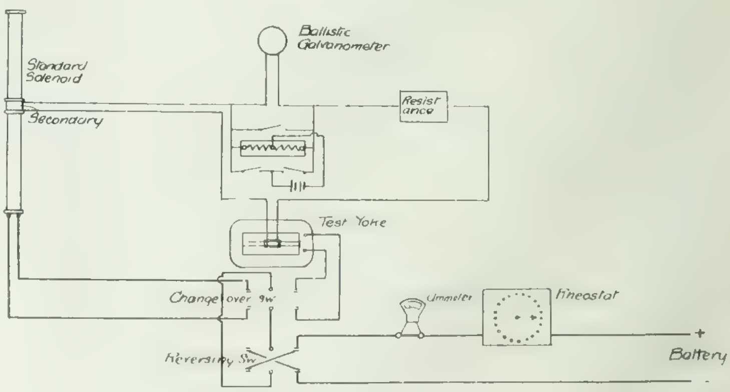

Fig. 1—Connections for ballistic test.

resistance, 2.127 ohms at 17 degrees C. The magnetic length of the sample is 17.05 cms., consequently $H = 4\pi/10 \times 407 \times I\ 17.05 = 30\ I$; so that the value of H is just 30 times the ammeter reading, and the value of ampere-turns per unit length is (from the fundamental equations) 2.02 H.

In preparing the samples for test it is most essential that the area be correctly estimated. With sheet iron particularly this is very difficult, using gauge and calipers. A better method, therefore, is to take the density of the different classes of iron and steel, to weigh each sample bundle and to calculate the area from the weight, length, and density.

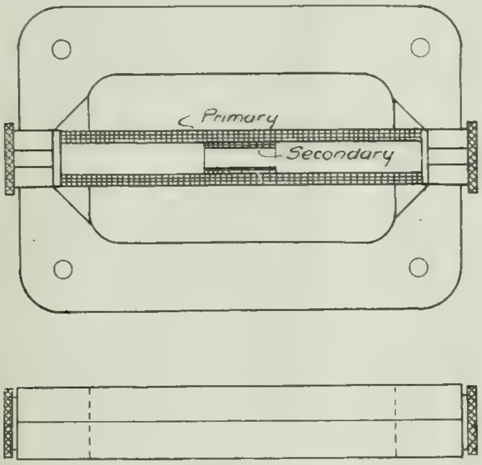

Fig. 2—Diagram of testing yoke.

The figures for a typical permeability test are given in the table which shows the range commonly employed. Hysteresis loss is obtained by plotting out the loop between the limits B = 8,000. To effect this a rheostat is connected in series with the primary circuit. The rheostat has four steps controlled by spring triggers, so that it is possible to insert resistance suddenly. Now, the sample is carefully demagnetized and the magnetization brought up until B = 8,000, when, by use of the trigger, resistance is inserted and the flux density falls to the point b (Fig. 3). Next the resistance is cut out again, bringing the value of B up to 8,000 and the circuit is suddenly opened, giving the point C the remanent flux. It should be noted here that the galvanometer indicates the difference between the maximum B of 8,000 and the values of the points b and c. This difference has, therefore, to be subtracted from 8,000 to get the value of the other two points. For the other side of the axis the resistance is adjusted on open circuit and the circuit suddenly closed with gradually increasing values of -H, thus obtaining the points d, e, f, etc., the number of points depending merely upon the number of resistance steps. This would appear to yield only one side of the loop, however, by reversing the switch in the primary circuit exactly the same procedure is followed out for the other side. This is one of the most reliable methods of obtaining the hysteresis loop which can be performed in a commercial test room. It will be seen that, broadly, the method is to base all the readings (excepting point b) upon the remanent magnetism, which is the most stable point on the curve.

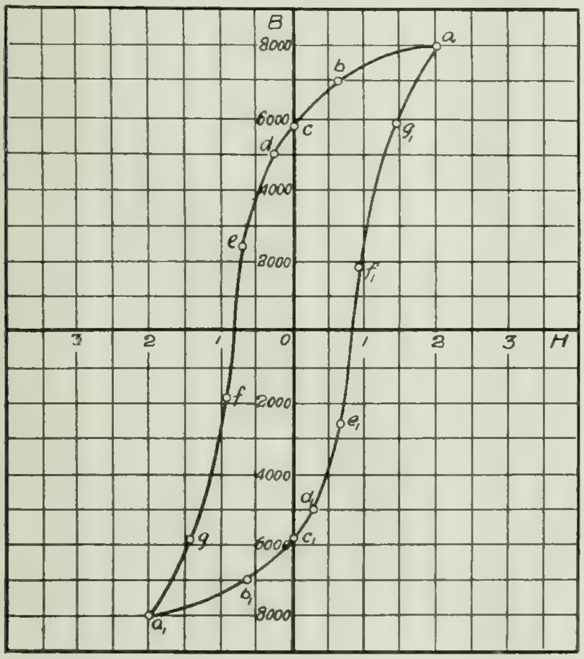

Fig. 3—Hysteresis loop for special high resistance silicon steel.

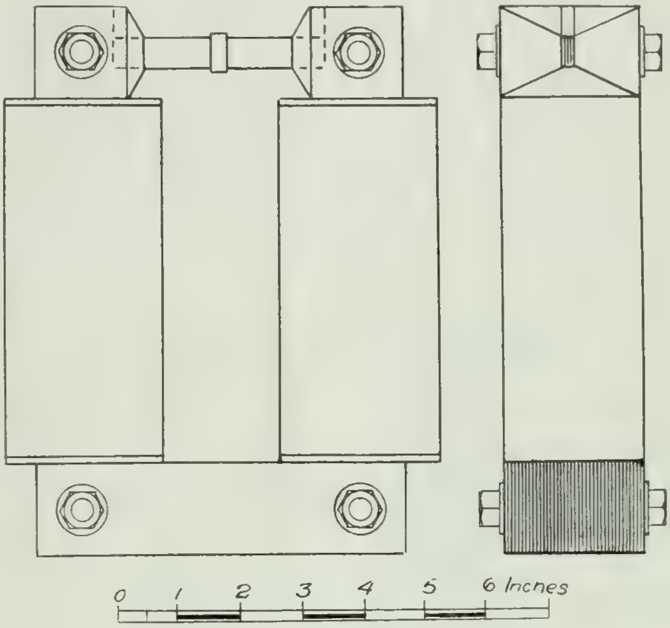

Fig. 4—The Pannell-Thompson high induction permeameter. On the left, elevation; on the right, section through core.

Permeability Test on Special Silicon Steel.

H.	B.	U.	Amp. turns per inch.	Lines per sq. inch.
5.94	3,520	594	12	22,700
8.91	6,600	741	18	42,600
11.88	9,110	777	24	58,600
17.82	10,880	611	36	70,200
23.76	13,480	568	48	87,000
29.70	14,410	485	60	92,900
44.55	15,700	353	90	101,200
59.4	16,440	277	120	106,000
89.1	17,450	196	180	112,400
118.8	18,150	153	240	117,000
148.5	18,600	125	300	120,000

Specific resistance at 16 degrees C. 15.2 microhms per cm. cube.

In certain classes of electrical machinery, notably in the case of railway motors, the induction in the armature teeth is forced up to very high limits. It is, therefore, necessary to know the characteristics of the iron at these very high flux densities. The testing yoke described above is unsuitable for these tests, because its windings would not carry the heavy currents necessary. It is required to obtain a magnetization of nearly 2,000 ampereturn per inch (H 990). If a ring sample be employed a two-layer primary winding of No. 14 B and S will give about 25 turns to the inch, thus taking a current of 80 amperes for the above magnetization. For this purpose the whole sample must be immersed in an ed with the readings taken rapidly with intervals for cooling. Fig. 5 shows the magnetization curve taken by this method on a ring made up of transformer steel punchings. Higher values of magnetization cannot be obtained upon a ring because a winding of more than two layers would be subject to serious errors, due to the air space included by the coil. At these high densities the permeability of air is relatively little lower than that of iron, and the flux will not, therefore, be confined to the latter. A special form of isthmus yoke on the lines of that originally introduced by Ewing is necessary, provided that proper compensation is made for the end effect. The yoke shown in Fig. 4 is a typical form used by the writer. The main limbs of the yoke are wound with the primary, and the specimen between the jaws carries the secondary in series with the galvanometer. The area and permeability of the yoke is so much greater than that of the sample that it is neglected, and the whole of the ampere turns on the yoke charged against the length of the specimen. As before mentioned, however, the flux will tend to spread out near the ends of the sample, taking a path through the air into the jaws of the yoke; and, although the value of this leakage can be obtained by winding secondary coils at the ends as well as at the middle of the specimen, the virtual magnetic length of the specimen cannot be so easily estimated. The matter is complicated further by the fact that this quantity will vary with every reading as the high inductions are reached, becoming shorter and shorter.

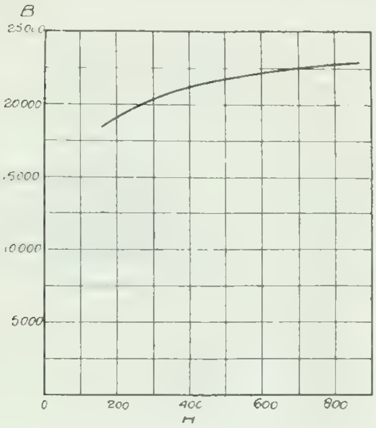

Fig. 5—Curve for high inductions in sheet steel; ring sample.

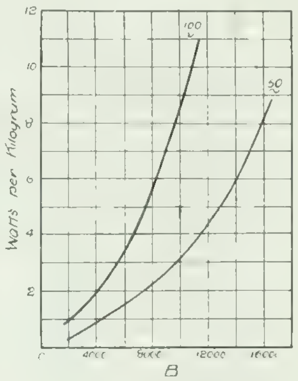

Fig. 6 — Total core loss in .014 sheet iron ring punchings, japanned both sides.

Recent experiments made by Messrs. Campbell and Dye at the National Physical Laboratory employ a method which, like most magnetic measurements, is originally due to the genius of Prof. Ewing. We know that H, the magnetizing force, is 4π times the ampere turns divided by the magnetic length, and the only quantity which we cannot evaluate is this magnetic length. Now H is also equal to B in air, or where the permeability is unity. If, therefore, we can read the flux density in the air as closely as possible to the iron sample we can at once estimate H and the ampere turns per inch with the greatest accuracy. This is effected by winding a secondary around the outer and inner walls of an ebonite shell, which latter encloses the iron, though the winding does not. The area enclosed by the winding is calculated from the thickness of the shell. If a ballistic galvanometer is connected up in series it will indicate on reversal the value of H, whilst the true secondary enclosing the iron sample will, of course, give deflections proportional to B.

Permeability bridges, hysteresis testers, and direct reading methods of magnetic testing are likely to have but little application in commercial work because their accuracy is not, as a rule, sufficient for tests upon which the acceptance or rejection of a shipment must depend. In alternating current work, however, a more important test than any of those described is the wattmeter test. This gives the combined losses due to hysteresis and eddy currents at the working frequency and flux density. The hysteresis under these conditions is very different from that obtained on the slow cycle already described, although both results are of value. The method is to connect up a ring of punchings wound with a single winding in a circuit of sinusoidal E. M. F., and to read volts, amperes, and watts at different loads for both 60 and 120 cycles. The value of B is derived from the voltage equation where $V = 4.44\ S \times \text{cycles} \times Ba./10^8$. Correcting for the I^2R loss in the ring winding and wattmeter series coil, the remaining watts give the core loss which can be divided into hysteresis and eddies by figuring the latter as proportional to the square of the periodicity.

The Electric Club Luncheon Feb. 2

At the next luncheon of the Electric Club of Toronto, on Friday, Feb. 2, Professor J. C. McLennan, Director of the Physical Laboratory, University of Toronto, and a member of the recently appointed Research Advisory Council, will be present and address the members. The Advisory Council has as its primary aim the organization of a working arrangement whereby the experience of our men of science may be utilized in furthering the commercial development of our country, and it is along these lines that Professor McLennan will speak.

Prince George, Friday, Feb. 2, 12.30.

Electric Vehicles in Department Stores

One of the largest department stores in New York City, of international reputation, has found, from its accurately-kept operating records, spread over a long term of years, that the total efficiency of its gasoline delivery wagons, numbering over one hundred, is between 70 and 90 per cent. The lower efficiency is obtained from small cars of low first cost, while the 90 per cent. efficiency service is secured from the highest type of gasoline delivery wagon.

Contrasted with this relatively low efficiency is the very remarkable percentage shown by the electric delivery vehicles operated by this firm—an efficiency of 98 per cent. Statistics may be rather dry reading, but such efficiency as has been obtained in practice by this department store with its electric vehicle equipment should greatly interest establishments whose delivery systems are similar.

It is also of interest to note that while gasoline cars, on account of insurance, are compelled to load from the exterior of the building, this firm's electric delivery wagons actually go into the building proper and, through the agency of large elevators, are transported to various floors, at which central points the wagons are loaded, thus saving expensive handling of packages. This simple method of handling the electric vehicle and its contents, which is permissible owing to the total absence of fire hazard, considerably speeds up deliveries. When the electric vehicle reaches the street a high average speed is maintained, owing to the "electric's" ability to rapidily accelerate, its simplicity and positiveness of operation making for progress even under adverse traffic conditions.

When it is also realized that stopping and starting of electric vehicles for delivery purposes does not impose any particular hardships on the simple mechanism of the "electric," and that when the "electric" is at rest no energy is being consumed, and the aforementioned efficiency obtained in actual practice is also taken into consideration, it is not difficult to understand why concerns who carefully record operating data should extensively employ the electric vehicle

The Electric Club of Toronto Very Active in the New Year

The Electric Club of Toronto was addressed on January 12 by Captain D. M. Mathieson, C.E., M.C. Captain Mathieson is recently returned from the Canadian front line in France and gave a realistic description of the work the engineers are doing. He showed a number of drawings illustrating the plans and methods of construction of the different types of trench defenses. The speaker again emphasized the value of the man, in this war, who has had experience and training in construction work. Especially there is need at the present time for men who can take charge of gangs of workmen and direct their work intelligently. This is the man generally known as a "sapper." He is, in effect, a superintendent of construction with anywhere up to two hundred men, taken generally from the ranks of some combatant battalion. Such men are now wanted for the engineering battalions at present enlisting, and Captain Mathieson will be glad to get in touch with any man who would be capable of doing work of this nature.

The club on January 5 had as guest Rev. Byron Stauffer, who spoke on the subject, "Does the Golden Rule Conflict with the Slide Rule?"

Visit to the G. N. W.

On Friday, January 19, the Club visited the operating rooms of the G. N. W. Telegraph Company, where they were shown the internal workings of this large system of continent-wide communciation. The party first visited the switchboard room, where is installed a steel frame switchboard of the Bunnell type with a capacity of 100 wires, and having an auxiliary loop switch with 40 loops for newspapers and brokers' services. Next in order they visited the multiplex department, containing four quadruplexes and 16 duplexes and having 10 sets in operation all the time; the repeater department, containing 20 sets of repeaters of various types; the Morse single wire department, where there are 36 wires, 24 of which are incorporated in two up-to-date concentrators; the city department, where 24 city wires are incorporated in one up-to-date concentrator; the ticker department, where New York stock tickers, Chicago grain tickers, Toronto Stock Exchange and Toronto Mining Exchange tickers are in operation; the telephone department, where there are 11 trunk lines and 10 extensions, with 15 telephone operators continually employed, and finally, the telegraph school, where novices are trained to become expert in the use of the various equipment.

Probably the most interesting department visited was that which contained the Morkrum automatic printing telegraph apparatus. For the better understanding of this equipment the company had gone to the trouble of having a sample set installed for the inspection of the members of the Club, and this set was shown in operation. This machine operates at the sending end like an ordinary typewriter, the signals being transmitted entirely automatically, and the message being delivered at the receiving end in ordinary printed-letter form—that is, everything is entirely automatic, except for the one operator who works the typewriter keyboard at the sending end. In the Toronto office there are installed two Morkrum sets Toronto to Montreal, one set Toronto to Ottawa, one Toronto to New York, one Toronto to Buffalo, and one Toronto to Chicago. The company also operate from Montreal as a centre, one set Montreal to Ottawa, one set Montreal to Quebec, one Montreal to New York, and one Montreal to Boston; also from Winnipeg as a centre, one set Winnipeg to Chicago, one Winnipeg to Minneapolis, and one Winnipeg to Saskatoon.

The Club are greatly indebted to the G. N. W. management, and more particularly to Mr. Lillie and Mr. Davies, through whose kindness their visit was made so intensely interesting.

National Service

"The One and Only Question"—National Service—was the subject of an address by Mr. A. McA. Murphy, of the Charles Gurd Company, at the Montreal electrical luncheon on January 17. The speech, illuminated by several humorous touches, was a forceful plea for the co-operation of every citizen in the national service movement. No happier thought, said Mr. Murphy, has ever been formulated for the benefit and inspiration of national life than is implied in the term "national service." At the moment it emphasized the call to war effort. Such a call at such a time was, of course, paramount. Every citizen should endorse it, and every true citizen would respond with willingness of spirit, whether his services were required or not—but to those who were forbidden enlistment, or who were not needed for the making of ammunition, the call was still insistent. Whatever their vocation, the idea and the ideal of national service would impel them to attain the highest degree of efficiency, the truest standard of personal integrity, and the fullest measure of brotherly sympathy, to the end that these qualities might, with increasing accuracy, reflect the prevailing characteristics of the Canadian spirit. "No slackers in any phase of the national life"—this ought to be the goal of every earnest Canadian.

Rental of Montreal Conduits

Judgment has been reserved in an appeal to the Appeal Court of the King's Bench, Montreal, from a decision of the chairman of the Quebec Public Utilities Commission relating to the rental of the Montreal underground conduits. The appeal was by the Montreal Light, Heat and Power Company, who desired the maintenance of a decision by the Electrical Commission, which had been reversed by the chairman of the Utilities Commission on an appeal by the city. The question at issue was the basis on which rentals should be charged, the Electrical Commission, supported by the light and power companies, holding that the users were liable only for the ducts actually occupied or reserved. The city, on the other hand, contended that the decision of the chairman of the Utilities Commission was right to the effect that the rentals ought to be based upon the cost of the entire system, including spare ducts.

Service and Unfailing Courtesy

The Bell Telephone Company, Montreal, sent to their employees a special appeal to support national registration. It states:

"The year opens with hundreds of our fellow-workers serving in the trenches and in training camps. Twenty-six of our number have laid down their lives for the cause. To us who remain behind the call to service comes with no less insistence than to those who have enlisted. We, too, are called upon to serve, and our obligation at this time is twofold:

"First, as good citizens, those of us who come within the terms of the act should loyally support the government in its campaign for national registration by promptly filling in and returning the registration cards sent out.

"Second, as loyal telephone workers, all of us should see that in our dealings with subscribers and the public we are courteous, obliging, tactful, considerate. Every subscriber has a right to expect no less than this from each of us.

"Let us begin the year right by cultivating from the start the spirit of service and of unfailing courtesy to the public."

The City of Westmount electric light department's revenue exceeded the expenditure and provision for depreciation, etc., for the year ending October, 1916, by the sum of $15,635.40.

Britannia Mining & Smelting Co. to Add to Their Hydro-Electric Development

The Britannia Mining and Smelting Company, Ltd., have recently completed plans for the extension of their hydro-electric development on their holdings at Britannia Beach, Howe Sound, about twenty miles northwest of Vancouver. The present development, utilizing the waters of Britannia and Mineral Creek at various heads, is a very complete scheme, and satisfactory for the present power requirements of this company's workings for the major portion of the year. At periods of low water, however, the power supply from hydraulic sources is insufficient, and is supplemented by a steam turbine plant. There is also a liability of the water supply becoming at times inadequate for use in the concentrating mill. These facts have led the company to secure the water rights in the next water shed to the south of Britannia Creek, which is known as "South Valley."

The utilization of the energy of this stream would most efficiently have been effected from a standpoint of total power by locating a power house at sea level at or near the mouth of the stream supplying this power. However, in view of the fact that the water may be required for use in the concentrating mill at Britannia Beach, and at periods of low water becomes almost invaluable for this purpose, the power from this stream is being developed by a hydro-electric unit in the company's present power plant adjacent to the above-mentioned mill. The water will be diverted from South Valley River at a suitable point where a dam can readily be constructed, and will give approximately 850 feet static head on the waterwheels at Britannia Beach. A pipe line some two and one-half miles long will be required to convey this water to the power house. A considerable portion of this pipe line, due to the rugged character of the country, will be through tunnels, and will be of special construction.

Storage on this watershed will be provided by the above-mentioned dam, by other dams located at suitable sites in the valley above the diverting dam, and also by the presence of small glaciers in the upper levels of the watershed. While this storage will not impound a very large quantity of water, still, due to the fairly high head at which the water is used and the fact that it is also required for ore dressing, this storage will be of great value during periods of minimum runoff on this and the adjacent watershed of Britannia Creek.

The generating unit will be located in an extension of the present Beach power house, and will consist of two Pelton-Doble impulse waterwheels, each of 1,850 h.p. capacity, driving a 2,500 kv.a. generator, 3 phase, 60 cycles, 6,600 volts, 720 r.p.m., rated at 2,000 kw., at 80 per cent. power factor. The generator is being built by the Canadian Westinghouse Company. The waterwheel runners will be mounted one on each end of the generator shaft, which is extended for that purpose. Each waterwheel runner is supplied with water by two needle nozzles, one Pelton oil pressure governor controlling the four streams. Additional features include main gate valves operated by hydraulic motors, and the control of the governor by an electric motor mounted upon the governor mechanism and operated from the generator switchboard. This last feature will enable one operator, instead of two, to synchronize this generator with the other generators in this plant, or with the nearby steam plant.

This electric generator, in common with those already installed, will be furnished with its own exciter, and will be practically a duplicate of the two present generators of like capacity in this plant, which are driven by waterwheels supplied with water from Britannia Creek.

Flexibility and reliability of operation are being provided for in a marked degree in this plant, due to the serious results following interruptions to the power supply in the mine and other workings. For this reason one of the present units will be [illegible] to the waterwheel equipment to enable it to be operated by either South Valley water or water from Britannia Creek. Thus there will be two units available for operation on either Britannia or South Valley water, as required.

Sufficient capacity is being installed so that one unit can always be held in reserve under the present plan of operation. With this end in view each generator has been supplied with its own exciter, simplifying switching arrangements and making the various units independent of any central exciter plant. Should it develop in future that all units might be required to be regularly in operation at one time, a central exciter of suitable capacity will be installed, provision having been made for this machine in the present layout.

The three generators are controlled by a Westinghouse generator voltage regulator of the latest type, embodying a number of new features, among others parallel operation of exciters not being required.

This installation as a whole is particularly interesting as being the largest hydro-electric power plant in Western Canada supplying power to one metal mine.

The Storage, Handling and Filtering of Insulating Oils

The matter of storage, handling, and filtering of insulating oils has probably been given too little attention by many of those handling oil-insulated electrical apparatus, for, even though the best grade of oil be used, its purpose is partially or wholly defeated if it is not handled properly. Insulating oils are generally shipped either in the tank with the apparatus, in soldered tin cans, or in steel drums provided with screw bungs, which are sealed before shipment. All oil in drums that are not sealed should be tested before using. Drums should always be placed on their sides for storage—never turned up on end, as such a position allows water to collect in the head around the bung. If at all possible, it is advisable to store drums in a closed room; if stored out of doors, protection from the weather should invariably be provided.

Too great precaution cannot be taken to insure the thorough drying out of all apparatus before filling with oil, and during the actual transferring of the oil from the drums to the tank every care must be taken to prevent any moisture getting into either the oil or the apparatus. A drum of cold oil when taken into a warm room will invariably "sweat," and the resulting moisture on the outer surface may mix with the oil as the latter flows from the drum. Before breaking the seal the drum should, therefore, be allowed to stand long enough to reach room temperature. All vessels used for transferring the oil should be carefully inspected, to see that they are absolutely dry and free from metallic or carbonaceous particles.

Immediately before placing the oil in the transformer or switch tanks care must be taken to remove thoroughly any particles of foreign matter, scale, etc., that may have adhered to the interior of the drum too firmly to be removed by the washing and drying the drum receives at the oil refinery before filling, but have become loosened by the continual swashing of the oil during transit. This matter can be conveniently removed by using a funnel of large size, with the top completely covered with two layers of any ordinary finely-woven cotton cambric that has been thoroughly washed and dried to remove the sizing, and passing the oil through this as a filter. The oil will pass through this filter more rapidly if slightly warm.

The thoroughness with which the filtering has been done may be determined by measuring the dielectric strength of the oil with a testing cup and spark gap.—The above is extracted from a booklet on "Feeder Voltage Regulators and Transformer Apparatus," published by the Westinghouse Electric and Manufacturing Company.

Electric Railways

Observations at the American Electric Railway Association Convention, Held at Atlantic City, N. J., Recently

By Mr. George L. Guy*

POWER DISTRIBUTION

(a) Revision of Specifications for Overhead Crossings of Electric Light and Power Lines.

As the National Joint Committee on Overhead and Underground Line Construction has been considering this subject for some months, and as the same committee has withheld the final revision of its specification until the Bureau of Standards Safety Code is in more permanent shape, it was decided to leave this matter open until the above-mentioned bodies had brought in a final recommendation.

(b) Revision of Standard Stranding Table.

The committee appointed on this subject worked in conjunction with a committee of the A.I.E.E. and brought in a recommendation in the form of a revised table. The change in standards was thought necessary in order to provide a more varied classification, and in some cases to cheapen the cost of production, due to a smaller number of wires in each cable. As each one of you will have a copy of the A.I.E.E. standardization rules, and as the revised tables will be published and accessable, I have not considered it necessary to reproduce them. The old standard stranding table enumerated sizes up to 1,102,941 c.m. and in one recommended stranding only. The new tables standardize up to 2,000,000 c.m. section, and for three classes of flexibility—standard concentric, flexible, and apparatus cables. Some idea of the relative flexibility of the three classes may be obtained from the fact that a 2,000,000 c.m. concentric cable is made up of 91 wires having a diameter of 148.2 mils; a flexible cable of equal total cross section would have 703 wires of 53 mils dia., while an apparatus cable would have 2,257 wires of 30.2 mils diameter. It is quite apparent that the standard concentric cable would be suitable for aerial distribution purposes only. By standardizing in the proposed way it is thought, as such an increase of varieties is afforded, that the necessity of making up special cables will be obviated.

(c) Revision of Standard Specifications for Rubber Insulated Wire and Cable for Power Distribution Purposes.

The original specification as adopted covering insulation resistance gave a table of dividing temperature coefficients. It is apparent that to use a dividing coefficient is exactly the same as using its reciprocal as a multiplying coefficient, and much more expeditious. Further, the original table gave maximum and minimum coefficients for each degree of commercial temperature. Considerations of quality demand that the insulation resistance shall not vary too much with temperature. On the other hand, the necessity of preventing the manufacturer from making his megohms high by arbitrarily assuming a small variation with temperature, demands that the insulation resistance shall not be assumed to vary too little with temperature. As a compromise between these conflicting requirements it was decided to make the coefficients constant. It was also decided to use the multiplying coefficient in preference to the dividing.

Lead Sheath.

The original standard specifications provided only three thicknesses of lead sheaths for all the various cables. It called for ⅛ in. thickness on cables up to 2,000 mils; 9/64 in. on those up to 2,699 mils, and 5/32 in. on all larger than 2,699 mils. The recommended thicknesses were altered in accordance with the following table:

Diam. of Core in Inches.

0—0.299	4/64 inch
0.300—0.699	5/64 "
0.700—1.249	6/64 "
1.250—1.999	7/64 "
2.000—2.699	8/64 "
2.700 and over	9/64 "

Clause 22 of section 5 of Standard Specifications would therefore read: "If the wire or cable is to be furnished with a lead sheath instead of an outer covering of braid, as provided in the preceding paragraph, there shall be tightly formed about the core, i.e., **internal diameter of the lead sheath**, a lead sheath of uniform thickness, not less than that indicated in the above table."

Various rules of the A.I.E.E. came up for discussion. These pertained to the terminology of standard wires and cables, rating and performance of lightning arresters, standards for electric railways, third-rail systems, and standards for telephony and telegraphy.

In no case was there put forward in the opinion of the meeting any improvement in these rules, with the exception of the definition of the gauge of third rail. The A.I.E.E. Standardization Rules define it as follows:

"The distance, measured parallel to the plane of running rails, between the gauge line of the nearer track rail and the inside gauge line of the **contact surface** of the third rail."

The A.E.R.A. definition proposed is as follows:

"Distance measured parallel to plane of top of both running rails between gauge of nearest running rail and inside gauge line of third rail."

The latter seems preferable, because it mentions the plane of the top of both running rails and because the words "contact surface" seem superfluous.

Specifications for reinforced concrete poles and overhead line material were drafted and approved for use of the association. It is unnecessary to go into detail in these papers, as no doubt the same will be printed and made available for anyone particularly interested.

Engineering Accounting.

Speaking generally of this discussion, the first principle involved was the advisability of including overhead expenses in with interdepartmental charges. The consensus of opinion was that overhead expense should be included, because of the great desirability of having an understanding of the true cost of work as a basis of comparison with work done outside. However, on account of the likelihood of disturbing the accuracy of the records it was finally decided inadvisable to enter such charges. In the writer's opinion, such direct supervision over each department as can be definitely charged to that department, together with depreciation of particular plant in that department, should be charged, leaving only general management, supervision, interest, taxes, insurance, and profit to be distributed over the utility as a whole.

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* Electric Engineer to the Manitoba Public Utilities Commission.

It was gratifying to the writer to find the committee of the A.E.R.A. recommending the use of a continuous inventory similar to that prescribed by the Manitoba Public Utilities Commission. There were no members present who would not admit its value, though the majority appeared afraid such a system would be too elaborate and costly. The Federal Railway Commission of the United States and many state and tax commissions require such detail as to cost and present value of the various units of property that it is generally cheaper to keep the continuous inventory than to be investigating from time to time the information on each component part.

The continuous inventory shows at all times the cost and present value of all the various units of railway property. The two operating costs, without which no man can truly know the financial status or operating efficiency of any property, are interest on the investment and depreciation. How are these costs to be figured if the detailed investment is not known? Further, in cases of insurance and checking of assessments for taxation the present value of property units is invaluable. Other reasons advanced are its use in rate cases, for the issuance of securities, and for public information. Again, the true, actual cost of electric railway service in any locality cannot be determined without accurate information of this character. With the age, depreciation, and present value given of all property units as listed in the inventory valuable information is at hand for determining the proper sums to be set aside for depreciation and disclosing where replacements are urgent or likely to be necessary in the near future. With such information at hand it becomes possible to forecast accurately what the maintenance costs should be for succeeding years. By calculating the weighted age of property units it is possible to interpret the maintenance accounts with greater accuracy, and there is thus provided a gauge for checking operating efficiency.

It is hardly possible to show at this time the different forms recommended. Suffice to say that each unit of property is indexed, date property came into existence, number of similar units, original cost, expectancy of life, annual depreciation, value at end of each year, present value, betterments or additions, and corrected present value. In this way the history of each unit is kept, and it is possible at all times to know precisely the value of the property.

Block Signals and Highway Crossing Protection.

Lengthy consideration was given the subject of block signalling, especially with reference to standardizing its design, relative location and operation for interurban and urban electric and electric and steam railroads. It will be at once apparent to a casual observer what advantage it would be to have them all uniform in operation. Motormen changing from one system to another would likely read the signal as he was accustomed to, and if any difference in interpretation were used a wrong understanding would be had, with a possibility of accident.

The following requisites of installation were adopted:

1. Signals of prescribed form (design submitted, but not obtained), the indications given being in not more than three positions, by lights of prescribed color, or both. The horizontal position of the target indicates "stop." A red lamp signal has the same meaning. When the target is in an inclined position of 45 degrees upward it indicates "caution"; a yellow lamp having the same significance; with the target vertically upward it indicates "proceed"; a green lamp having the same meaning.

2. The apparatus so constructed that the failure of any part controlling the operation of a signal will cause it to display its most restrictive indication.

3. Signals located preferably over or upon the right of adjoining track to which they refer.

4. Semaphore arms that govern, displayed to the left of the signal mast, as seen from an approaching train.

5. Continuous track circuits.

6. Signal connections and operating mechanisms so arranged that a home block signal will display the stop indication after the front of a train shall have passed it.

7. Switches in the main track so connected with the block signals that the home block signal in the direction of approaching trains will display the stop indications when the switch is not set for the main track.

The following recommendations were made with reference to protective signals at highway crossings:

1. Any device designed for the protection of the public at railway crossings that depends wholly upon the public observation of it to accomplish the end sought should be conspicuously located and readily visible at a considerable distance from the point of danger.

2. It should appeal to both the sense of sight and of hearing, both by day and by night, to meet defects in these senses of many of those for whose protection it is intended.

3. Its danger warning should be such as to excite by its contrast with other sounds or objects an immediate alertness in those not conscious of approaching danger, however much they may be absorbed in the observance of other things at the same time.

4. It should be of simple design, capable of continual operation over long periods without attention.

5. It should be free from interference by those maliciously inclined, by the elements, and by extreme temperature changes.

6. It should permit of a material variation in potential of the energy by which it is operated without affecting the reliability of its action or the distinctness of the warning it produces.

7. It should be as reasonable in first cost and in maintenance as the character of the service it is to render and the variety of conditions it must operate under will permit.

8. If electrically operated it should be adapted to be operative by either a.c. or d.c. energy of any potential or frequency that conditions may justify the use of in this service.

9. It should be so arranged that, if thought desirable, indications to the motorman of approaching cars can be given to show if the device is operating properly.

10. It should be so designed that the failure in one part of the signal mechanism will not affect the other forms of indication.

One-Man Car Operation.

There seems to be a general agreement that one-man cars are not suitable for operation where traffic congestion is great and where considerable loading and unloading of cars takes place. In such cases the motorman's attention is required in the operation of the car to avoid accidents and delay resulting from traffic interference, and the additional duties of issuing and receiving transfers and collecting fares would seriously delay the schedules.

In competition with jitneys, the principal advantage of the one-man car from the standpoint of the public is the greater frequency, reliability and convenience of the service. It is obvious that there is a saving in fixed charges, as the capital invested per car is less, the weight being less, the cost of power will be decreased, and the cost of operation of the car will be cut in two. Outside of residential districts, when very light traffic exists it would be necessary to increase the number of cars to accommodate the travelling public, so it is extremely difficult to estimate with any degree of accuracy what the ultimate saving may be. It can only be ascertained by a study of the conditions under which the one-man car is to be operated. It seems to the writer that these cars are especially suitable for night traffic. If these were used on feeder and suburban districts during the day and over the main thoroughfares during the night, say from 11 o'clock till 2, that they would prove economical, besides being able to afford a more frequent and satisfactory night service.

POWER GENERATION.

(a) Revision of Standards.

Many of the A.I.E.E. standardization rules were brought up for discussion. Among the more important recommendations made were as follows:

1. That the thermal limit of electrical machinery be put on the basis of "ultimate temperature" and not "temperature rise," and that these ultimate temperatures are respectively 95 degrees Cent., 105 degrees Cent., and 125 degrees Cent. for the various classes of insulating materials, with specified corrections based on the method of measurement. The class of insulation having the lowest temperature limit would include cotton, silk, paper, etc., untreated. The intermediate limit would include the same substances when treated or when immersed in oil. The highest limit would apply to mica, asbestos, and similar heat-resisting materials employing a binder for structural purposes. The above limits would be modified with respect to the mode of measurement of the temperature. Deduction from the ultimate temperature of 15 degrees would be made if temperature were measured by thermometers, 10 degrees C. if measured by resistance method, and 5 to 10 degrees C. if measured by imbedded temperature detectors. I believe the above to be a step in the right direction, as, according to the A.I.E.E. rules, the limit is measured by a rise of so many degrees (25 degrees for most machinery) above ambient temperature. The ambient temperature varies so widely and in some cases is so high that a further rise of temperature might endanger the life of the machine.

Another recommended change was to the effect that lightning arresters be rated according to the minimum voltage at which they discharge, and in terms of a minimum and maximum percentage range of the normal voltage of the circuit they protect. I do not believe this will be feasible, as the minimum voltage of discharge varies widely with the wave shape of the impressed voltages, the nature of the front of the wave, and the frequency. Surges, static discharges, and lightning vary in rapidity of oscillations and voltage through such tremendous limits that a name plate rating would probably lead to considerable trouble. High frequency discharges would jump a much smaller gap than ordinary commercial frequencies of similar voltage, in which case an arrester set for a line voltage and frequency would be much too sensitive to give satisfaction in operation.

It was also recommended that the momentary commutation limit on continuously rated machines be not less than 200 per cent. of the continuous rating in amperes instead of 150 per cent. It seems to the writer that this requirement will merely raise the continuous rating of the machine. From treatises on machine design there appears to be a practical limit to the commutation correction by interpoles for any sized frame without disturbing the commutation at normal loads.

The introduction of the commutating pole into the design of synchronous converters has so greatly extended the permissible commutating limits that much higher speeds and correspondingly greater kilowatt capacities per pole have been made possible. Commutation has in almost all cases, and particularly with 60-cycle apparatus, been the limiting factor in rating the capacity of those machines. The use of the commutating pole has been supplemented by improved quality in brushes permitting higher densities in amperes per square inch. Along with these improvements in commutation have come other refinements in design, such as better quality of iron, permitting greater flux densities, improved methods of ventilation, employing the cooling effect of large quantities of air automatically driven through the windings of the machine by its rotation, and the use of better grades of heat-resisting insulation. The designing engineer is working consistently along every line for improvements in construction, operating, and lasting methods, and has, no doubt, accomplished his utmost in commutation at the present state of the art. It will be for he designing engineer o state what limit of commutation can be obtained with satisfactory construction and operation.

At this point specifications covering material, workmanship, and design of special work and general track construction were considered. On account of the voluminous detail of this work and the fact that it will be of little general interest, no consideration will be given the subject here, with the exception of the treating of ties, poles, and crossarms. Information elicited from numerous utilities brought out the fact that treating ties increased their life from six to seven years untreated to fifteen to twenty years treated. The annual charges after treating would be reduced from 12 to 33 1/3 per cent., which is a great consideration. The average life of poles would be increased from fourteen to thirty years, reducing the annual charges by about 37½ per cent., after considering the cost of butt treatment of cedar poles. The average life of fir crossarms would be increased from fifteen years to about twenty years, reducing the annual charges by about 12 per cent. The most satisfactory treatment was thought to be dipping in creosote in open tanks. Experience proved that there was no advantage in the full-cell creosote pressure treatment, which cost over 100 per cent. more to treat. The best creosote oil to use is covered by the following specifications:

"The oil used shall be the best obtainable grade of coal-tar creosote; that it shall be a pure product, obtained from coal gas tar or coke oven tar, and shall be free from any tar, oil, or residue. It shall be completely liquid at 38 degrees Cent., having a specific gravity at that temperature of 103."

A paper was read on "Heavy Electric Traction," which was merely a compilation of statistics on modern electric locomotives, covering both American and European practice. The statistics shown seemed to show that every operating company had a design of its own, specially suited to local conditions. Every system of power service was employed—two-phase, three-phase, single-phase, d.c. and combinations of single-phase a.c. and d.c. There was nothing to indicate that there was any tendency to adopt any particular system, weight, speed, voltage, or frequency.

Other papers were read on buildings and structures, discussing specifications covering construction, public relations, and even on the operation of motor vehicles—the commonly called jitney being a member of that class. It seems strange to remark that all were of one accord as to the life of the jitney, and figures were given showing that it would be impossible for them to continue, as they operated at a loss. Gasoline, according to the statistics, cost 19c, yet it is marvellous to note that they are still running with gasoline at 46c.

EXHIBITS.

While the papers were interesting and instructive, the exhibition seemed to practically drive home more ideas of late development in design and equipment than would be absorbed from papers and discussions. The latter dealt theoretically for most part, while the former showed the practical side. The exhibits showed the keen, untiring interest the manufacmer has taken in working out the problems of bettering the conditions and solving the problems of the operating companies. There was hardly an article which goes into service in the equipping of electric railway systems which was not exhibited. At one booth there was nothing else exhibited but a patented self-spreading cotter pin, while another exhibit was a complete one man operated car. It would be impossible to describe any great number of the exhibits, so a few which impressed the writer most will be selected.

Probably the most striking development is that in railway motors. It seems strange to relate, but nevertheless it is an actual fact that it is only within the last two or three years that railway companies have begun to realize the value of lightweight equipment. Reduction in weight reduces maintenance and repairs on track and special work. It also reduces the power required for operation. More especially is this true at starting. The standard single-end car used by the Winnipeg Electric Railway Company, weighing about 26 tons light, is equipped with four 37½ h.p. motors, making a total of 150 h.p. nominal rating. On starting on level tangent track with four seconds stop on each notch of a K6 controller (corresponds to uniform acceleration of 2.7 miles per hour per second) these motors are called on for a combined mechanical output of 235-240 h.p. After coming up to full speed the required power drops down to approximately 40 h.p. It requires a distance of about three and a half city blocks (265 feet) in which to bring a car up to free running or full speed. It is quite apparent, then, especially in rush hour traffic, with cars stopping at every other block, that cars seldom get up to full speed. This means that the motors are doing work for most of the time of motion in accelerating the car requiring considerable power. This power is directly proportional to the mass, the energy of acceleration being equal to $m s^2/2 = w s^2/31$ in foot pounds. Therefore, by reducing the weight of cars the starting energy is reduced in proportion, thereby making a direct saving in cost of operation. To meet the demand for light equipment the manufacturers have developed motors which cut the old weights of equal capacity motors in two.

The Westinghouse "Wee" motor is designed especially for the small, one-man cars. It is rated at 25 h.p., 600 volts, a weight of 890 pounds. The service rating is higher than that of the old 35 h.p. motor and yet the weight is less than half. The factors effecting development are:

1. The use of interpoles, improving commutation, which with heating limits the capacity of a direct-current machine.

2. Forced ventilation dissipating the heat rapidly.

3. Improved quality of silicon steel, which permits of high flux densities.

Other capacities, 40 h.p., or "Baby Motor," 50-65 and 95, weighing respectively 1,700-2,325-2,700 and 3,125 pounds.

The General Electric Company have also put out a similar line. The G. E. 258 corresponds to the Wee Motor No. 506. It has a rating of 25 h.p. for one hour, at 600 volts, and a weight complete of 885 pounds. One of these motors was on exhibition in operation in a tank, with a stream of water playing on the ventilation ducts, apparently unharmed.

There is a difference in design between the two manufacturer's above noted. The G. E. Company make use of a four interpole symmetrical layout, while the Westinghouse omit one interpole, on the side next to the journal box lugs. As the above armature is series wound, compensation for this omission is made by increasing proportionately the field on the other three poles. This construction permits of hanging the motor immediately adjacent to the axle, saving space, increasing weight on the driving wheels, and making all parts of the motor readily disassembled. It should be noted, also, that this lightweight design of motors is made in a box frame type, and not split frame, as was the case in the older motors.

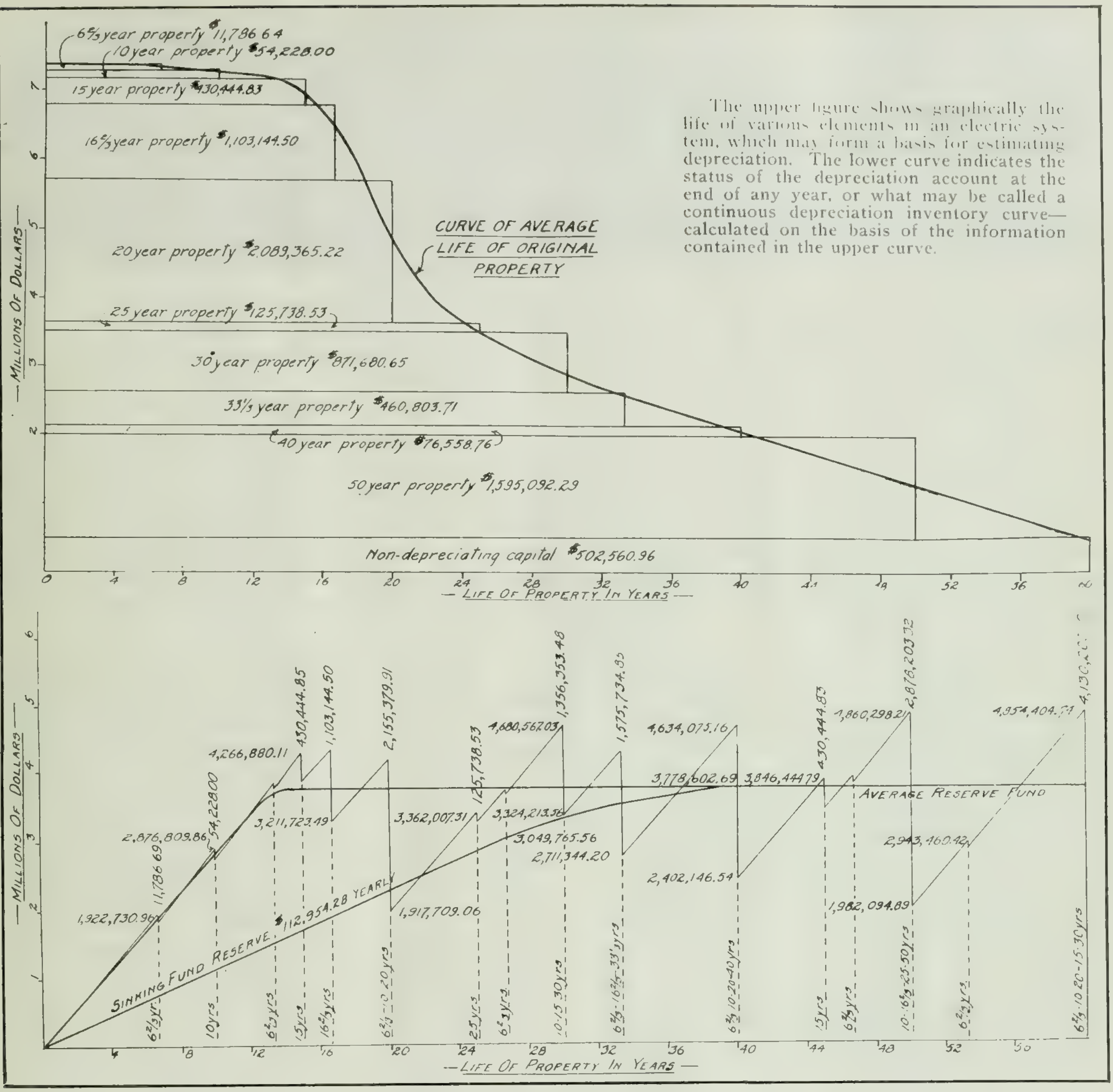
Another development worthy of notice is that in control apparatus. The Westinghouse Company have developed what is known as the H. L. and H. L. D. types of electro-pneumatic control. These are used on city, interurban, subway, or elevated railroads. It permits all main power circuits and circuit-breaking devices to be removed from the platform and located beneath the floor, thus economizing space and removing a source of danger and accident from the public. This is especially necessary on cars with front exists, or where the public is allowed to stand in the front vestibule. Only a master controller with very small currents is used by the motorman. This master controller operates the reverser, main switch, and contactors encased underneath the car. The small control currents operate air valves connected to cylinders and plungers which open and close the contactors. Each contactor is opened and closed with a quick make and break, and is held open or closed by a force of approximately 100 pounds. Another advantage of this system is that motormen cannot plug the motors—i.e., throw the controller handle around too quickly, so as to jerk the car ahead, much to the discomfort of passengers. He may throw the master control handle around, but in the construction an adjustable time-limiting device requires a predetermined interval of time between the closing of successive contactors, thereby ensuring a uniform, steady acceleration. The G. E. Company have developed their type M control to obtain similar results to the above in their type R. C. 10A system. The G. E. Company operate the contactors by solenoids.

The Lackawanna Steel Company, Buffalo, exhibited an improved rail joint which should prove serviceable. Two plates are shown of it. Suspended rail joints are centered over a base plate which has the sides turned down or up. The sides act as braces, making the surface rigid. Strap or standard fish-plates can be used to give the rails extra support in alignment. The base plate is brazed to the bottom flanges of the rail, making one continuous metallic connection throughout. The joint can be made with the aid of a portable oxy-acetylene welder, many forms in actual operation being exhibited. Any desired conductivity or stability can be obtained by simply adding sufficient spelter to build up the joint. With the high cost of copper and continual theft of bonds, and the usual joint resistance, this joint should be very economical and satisfactory, both from a track maintenance and electrolysis standpoint.

While almost every conceivable appliance for use with railway systems, such as compressors, trucks, patent door tickets, registers, signal lamps, ventilators, meters, wires and cables, couplers, ball bearings, repair trucks and wagons, trackwork materials, sanitary seats, strap hangers, air and mechanical retrievers, brakes, heaters, etc., covering acres of floor space were exhibited, it is impossible to even refer to any except those worthy of special mention. Many new appliances that were merly fads and unworthy of serious consideration were displayed. Standard materials, however, comprised the major part of the exhibition.

There is but one more matter of which I will speak, and in which marked development has taken place. This is the latest process for the manufacture of steel wheels and heat-treated gears and pinions. The former is a cast steel, combined with manganese in the tread and plunge portion, with a dustile steel plate and hub. Samples of wheels were exhibited sawn transversely from the periphery to the centre. These were then bent in various shapes under tremendous pressure. Such material would obviate the not unusual breaking of flanges with the incident derailing of the car.

The method by which the two kinds of steel are incorporated is of special interest. The mould is revolved while pouring, and the first metal entering is treated with ferro-manganese during its passage from the ladle into the mould. It is then thrown to the tread and flange by centrifugal action



The upper figure shows graphically the life of various elements in an electric system, which may form a basis for estimating depreciation. The lower curve indicates the status of the depreciation account at the end of any year, or what may be called a continuous depreciation inventory curve—calculated on the basis of the information contained in the upper curve.

As the pouring continues the manganese steel rim gradually blends into the ductile steel plate and hub by tapering of the ferro-manganese treatment. After casting, the treads are ground to contour. Records of these in use indicate an average life of four times the cast-iron wheel, with decreased cost of maintenance. It was stated that the coefficient of friction between this wheel and A.S.C.E. specification 80-pound rail is over 9 per cent. higher than with the ordinary cast-iron wheel. This quality would be a decided advantage in starting accelerations and braking, as it reduces the amount of wheel slippage.

With regard to heat-treated gears, both solid and flexible were displayed, and under actual test. The heat treatment produces gearing that has the greatest possible wearing quality, combined with strength and toughness. The heat treatment consists in heating to the proper temperature in a furnace in which the heat is uniformly controlled, and cooling by quenching in a solution, the composition of which varies with the grade of steel and the results to be obtained. This process imparts a high tensile strength, elasticity, structure, refinement, and surface hardness. After the treatment, or even during the process, the hardness of each piece is determined either by the Brinell or Scleroscope methods, to insure each being brought to exactly the predetermined hardness. Both these instruments were shown in actual test of parts at the exhibition.

Quebec Railway Increases

A report from Quebec states that substantial increases were made in the traffic of the Quebec Railway, Light, Heat, and Power Company and of the Montmorency division during the six months ending December 31. The number of passengers carried on the city lines from July 1 to December 31 was 7,396,331, an increase of 829,710, as compared with the corresponding period in 1915. The Montmorency division figures are: 1916, six months, 1,200,214, an increase of 156,411, making a total increase in the company's tramway's traffic of nearly a million passengers.

The Dealer and Contractor

The Fire Hazard of Electric Irons—Contractors will help the Electrical Industry most by Emphasizing the Necessity for Caution in the use of all Electric Devices

The National Fire Protection Association recently sent out an illustrated bulletin drawing attention to the fire hazard necessarily associated with the careless use of electric irons. Unfortunately the electric is not yet as foolproof as it is convenient, and it is well that users of all electrical equipment should be advised of the necessity of using a certain amount of caution, which in no way detracts from the convenience or usefulness of the articles themselves. The following extracts covering the situation particularly with regard to electric irons are taken from the above mentioned bulletin:—

The Augusta, Georgia, conflagration of March, 1916, involving a property loss of over $4,000,000, is believed to have been caused by an electric pressing iron left in circuit in the dry goods store in which the fire broke out less than thirty minutes after closing.

Whether or not this surmise is correct, it is obvious that small fires easily become conflagrations when conditions are right, and that among the innumerable fires occurring from pressing irons, both gas and electric, there may at any time be one productive of a fire of great magnitude.

In New York City alone sixteen fires, involving property losses of from $5.00 to $400, occurred in 1914 from electric pressing irons which had been left in circuit; and twenty-seven in 1915. The 1916 budget of reports is already large, indicating a further increase. The appeal of the electric pressing iron is its convenience; it can be attached to any lamp socket in any part of the house or shop; but in this fact lies a large element of its hazard. These irons are found not only in the home, but also in many manufacturing or mercantile establishments, and the fires usually start from irons which have carelessly been left with the current on. Sometimes where irons are left connected, the current is turned on the circuit unknowingly by some person. Usually any combustible material in contact with the iron ignites. Following is a typical form of fire report:

This fire was caused by an electric pressing iron being left unattended and connected to the circuit. Fire communicated to the wooden table on which the iron was used, then to the building. The loss amounted to $70.30 on the building and $17 on the contents. The fire was extinguished by the fire department with chemical fire extinguishers.

Manufacturers, electricians and fire inspectors have long been aware of this hazard and have tried several ineffective means for safeguarding the use of electric irons. The first method was that of special stands so arranged that if the iron were allowed to remain with the current on, the amount of heat transmitted through the stand could not cause a fire. This safeguard was not satisfactory. Many of the stands were poorly designed, others became broken or were inconvenient to use, and there still remained the many instances where [illegible] person may leave the iron on the table instead of on the stand, or with inflammable material over it or against it.

The next step was an attempt to find some way to prevent a person leaving the current on without knowing it. A great deal of skill and ingenuity has been used in this direction with the result that many ideas have been brought forth. The first idea was to place a pilot light in series with the iron so that the current could not be used unless the pilot light was burning. This plan did not prove practicable for two reasons: first, the cost of the special lamp to carry the heavy current (3.7 amperes) used in electric irons; and, secondly, the amount of energy consumed by such a lamp. Users often adopted the plan of inserting a short-circuiting plug in place of the lamp, to save consumption of current.

Pilot Lamp

The next step was to connect a small pilot lamp in parallel with the flatiron or other heating device. This plan has received a great deal of attention by the electric fittings manufacturers, with the result that many attractive fittings called "heater control combinations," are on the market. They may be obtained in several capacities and in a wide variety of design, from the plain switch and socket combination base for use in factories, to the ornamental combination with the bull's-eye ruby glass pilot lamp mounted on a face plate for use in the home. This device, though developed to a high degree, as a remedy for the hazard is not all that could be desired. Such fittings are open to two sources of weakness: first, the little candelabra lamp burns out and need not be renewed since the lamp is wired in multiple with the flatiron and consequently is not necessary for its operation; the second and more important weakness is that people will so readily go off and leave the iron with the current on despite the burning pilot light danger signal. A third consideration is that the use of such a device confines the user of the iron to one particular electrical connection in a certain spot. This is all right for mercantile establishments, but not for the housewife whose inclination is to plug the iron into any lamp socket in kitchen, nursery, or summer piazza. However, this arrangement has undoubtedly prevented a great many fires, at least in shops, by offering a reminder to those who are not indifferent to the hazard, that the current is on the iron.

It is obvious that the problem must be attacked from another angle—that of the iron itself. It should be made "fool-proof." The temperature of a flatiron for safe and satisfactory use is from 400 to 600 degrees Fahrenheit. This temperature is not dangerous, but when the irons as now designed are allowed to remain with the current on continuously, their temperature rapidly increases to 1,200, 1,400 or even 1,800 degrees Fahrenheit in some instances, and the iron may reach a red heat. Needless to say, under such conditions any combustible material in contact with it will ignite. A more serviceable arson "plant" could hardly be devised!

It has long been known that it is perfectly possible to safeguard the electric pressing iron within itself. As in the case of the nitro-cellulose motion picture film, cheapness has been the determining factor. It is the American habit of mind to run any fire danger to save a dollar

Other Safety Devices

It is astonishing that in this interesting field of invention and manufacture there has been so little attention paid to the development of a satisfactory and commercially practicable safety device for electric pressing irons. While this line of invention has not been followed as actively as might have been expected, nevertheless some fairly successful attempts have been made. Certain members of the National Fire Protection Association have used for many years an electric pressing iron once produced by a manufacturer whose ideas of safety were in advance of his time. This device was driven off the market by the cheaper devices which are now causing daily fires. Its interior contained a pool of metal, which when a required temperature was reached, liquified sufficiently to release a spring which ejected the cord plug at the heel of the iron. Another attempt embodied an automatic switch in the handle cutting off the current when the handle was released. There has recently come upon the market, however, a device in which a thermostatic switch placed in the iron automatically cuts off the current whenever the temperature exceeds a predetermined range, usually 400 to 600 degrees Fahrenheit. This device not only greatly modifies the hazard, but offers many advantages in its practical use. A number of tests of it were made by Underwriters' Laboratories to determine the probability of fire starting from such an iron when left in contact with various combustible materials. The thermostat was set at the maximum of 600 degrees Fahrenheit and the current turned on. Photographs taken contrasted the result of these tests with similar tests made at the same time with an unguarded electric flatiron. Apparently with the iron upon a wood surface a maximum temperature of 600 degrees will cause a charring or "dry distillation" of the wood, but the tests seem to indicate that the danger of actual fire is not great.

It is to be hoped that in recognition of the undoubted hazard of the ordinary unprotected electric pressing iron, a more extensive development along these and similar lines will be stimulated by the co-operation of manufacturers, central station companies, inspection departments and others, to the end that this very convenient and now almost necessary household and factory appliance may be cleared of its present bad and probably increasingly bad reputation.

The pressing iron at its best is for its intended function, a source of heat. Any source of heat should be carefully safeguarded, and even such types of pressing irons as the one favorably described should be used only in a specific place, with an indicating device for the guidance of the user.

The use of the ordinary hazardous types, plugged into sockets anywhere with no indicating device to show when current is on them, should be discouraged, not only by the user, but by the public service corporation furnishing the current.

Making Hay While the Snow Flies

Every automobile owner knows that his car is always rendered useless while his battery is being attended to. Every automobile owner should know that during the winter months is the ideal time for a general overhauling of his storage battery—and, in fact, for the entire electrical equipment of his car. Also, every automobile owner should know that it is most imperative that his battery receive some kind of special attention during the cold months else that battery might be worthless in the spring.

Now then, there is no one better qualified to bring these matters to the attention of automobile owners than the electrical contractor and dealer. And there is no one who can do the work entailed better than the electrical contractor and dealer. Therefore the winter months present a sort of harvest time for the electrical contractor. Make hay while the snow flies.

The usual first question is: "How will I do it?" Well, here is one method of procedure: The first thing to do is to get in touch with every motorist in your territory. Write them a letter. Tell them your proposition. Tell them that you are in a better position—both from experience and facilities—to care for their batteries and entire automobile electrical equipment than is the garage man who does not specialize.

Send this letter out immediately for best results. Many autoists have already put their cars away for the winter. If one letter does not arouse as much enthusiasm as you had expected, follow it up in two weeks with another. Make the second one stronger than the first. Dwell particularly on the harm that the cold of January and February can do to the battery.

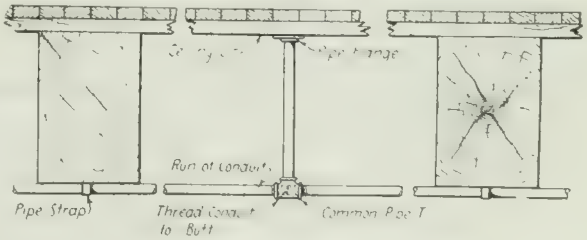
You might include an offer to inspect free of charge, the electrical equipment of the car. Owners will appreciate this and will naturally have it done while the car is out of service.

In soliciting the care of batteries during the winter months play up big your offer to call for the battery and deliver it again in the spring. This shows the owner the line of least resistance and impresses on him the fact that he has but to step to the phone to insure the proper care of his battery.

And right here is a wonderful opportunity to lay the foundation for future business. If you can get a man for the care of his battery—or entire electrical equipment—during the winter, you have an opportunity of getting on the inside of any other work that man might have in the future. If you can "deliver the goods" and you send him away satisfied you will undoubtedly be given an opportunity to at least bid on any electrical installation for his home, garage or store. He will seek you when he has trouble with his battery or ignition in the future. When he is considering buying any electrical appliances for his home or for gifts he turns to your store because of the satisfaction you have previously given him.

Supporting Conduit Between Beams in Mill Construction

The accompanying sketch shows a method that I sometimes have used for supporting conduit between the beams in buildings of mill construction when the hangers made for that purpose were not available. This method takes a little more time, but makes a very rigid and neat job. By threading the conduit into a T a coupling is dispensed with and a more stiff arrangement obtained. However, it is not essential to have the conduit joint come exactly at the pipe support; if it does not come so, the T must be large enough to allow the conduit to be slipped through easily.—C. W. Higinbotham, in Electrical Review.



Practical method of supporting conduit.

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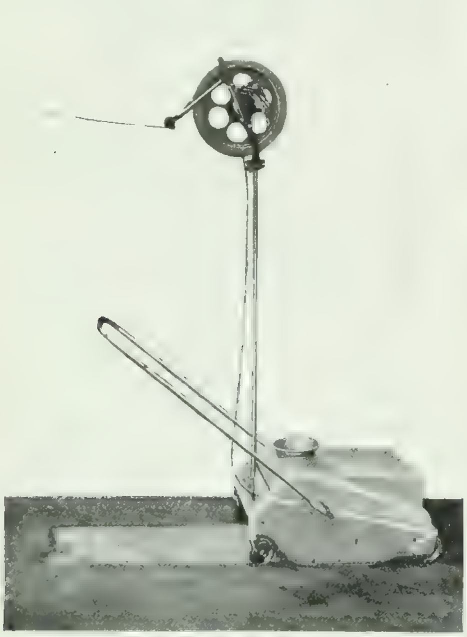
*By Howard P. Hildreth in National Electrical Contractor.

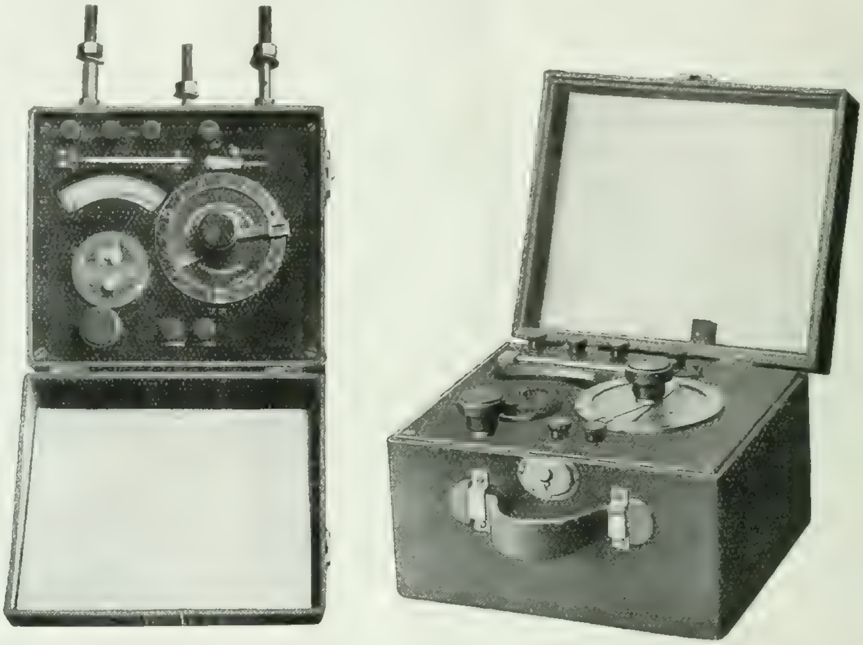
What is New in Electrical Equipment

Electrically Operated Scrubbing Machine

The illustration herewith shows an electrically operated scrubbing machine being placed on the market by the Dale Rey Corporation. This machine wets, sweeps, scrubs and dries the floor at a single operation. It requires only one attendant, who merely pushes the machine forward and guides it. The amount of water distributed on the floor is controlled from the handle. This water is immediately swept up by a cylindrical brush 16 inches wide and 20 inches in circumference. This brush is driven by a one-quarter horse power motor, chain connected, and revolving at the rate of 600 r.p.m. The brush scrubs and carries the dirt and soiled water over an apron into a separate receiving pan so that clean water is being continually used. The tank has a capacity for eight gallons. An upright, with cord reel attachment, keeps the wire away from the floor and the operator. Current may be taken from an ordinary lighting socket. The weight of the outfit is 100 pounds and it is claimed an attendant pushing it forward at a rate of one mile per hour can scrub an area of nearly 5,000 square feet per hour, or about five times the area that could be covered by hand in the same time.



The "Sanitary Stewart" automatic scrubbing machine.



Instruments for "hot spot" measurements.

Potentiometer for "Hot Spot" Temperature Measurement

The importance of knowing the temperature of the hottest part in electrical machines is now well recognized. The most accurate and reliable method of measuring temperature in parts of machines inaccessible to thermometers, is by means of a thermo-electric couple. The practice of building such couples into the windings of large machines at points where the highest temperatures are reached, though of comparatively recent origin, is fast becoming standard. The thermo-electric couple is found to be more reliable than copper wire pyrometer or search coils sometimes employed, for the reason that the necessarily delicate construction and insulation of such coils render them liable to undetected damage during construction or destruction at the most [illegible] due to severe conditions.

For measuring the temperature at a point where a thermo-electric couple has been installed a potentiometer is utilized. This instrument balances the electromotive force of the couple under test against that of another couple at known temperature. This avoids all errors due to variation in leads, etc., and as all indications are on the "null" or zero reading principle, very accurate readings are obtained. The reading is given directly in degrees centigrade. By using a dial switch, any number of thermo-couples on one machine, or on several, can be read at will with one potentiometer at any desired location. The potentiometer can also be employed for general testing work, such as resistance measurements in which electromotive forces of 5 millivolts or less are to be measured; the determination of temperature in other than electrical apparatus, such as bales of cotton or tobacco in course of curing, and for determining the internal temperature of coal storage piles and similar uses.

The potentiometer shown is manufactured by the Westinghouse Electric & Manufacturing Company, in portable and switchboard types, and combines in one case all necessary parts with the exception of the thermo-couple circuit. The case of the portable potentiometer is of polished wood. The switchboard type of instrument is mounted in a metal case with black finish. In both types, the scale range is 0-150 or 0-200 degrees centigrade.

The potentiometer case contains the "cold" couple which is in contact with the bulb of a mercury thermometer, by which the temperature of the cold couple is observed. A dry cell furnishes current to a resistance wire on which are two sliding contacts. The drop of potential between these contacts is proportional to the current in the wire and to the distance between them. A graduated scale and two pointers which move with the contacts indicate the position of the latter. Scale divisions on the millivolt scale are of equal width and are numbered to read direct in millivolts. Division on the temperature scale are spaced according to the e.m.f. law of the couple. A rheostat in the battery circuit is used for adjusting the current to the exact value that will cause a drop of e.m.f. per degree on the temperature scale to the thermo e.m.f. per degree in the couple. Leads from the thermo-couple connect through a sensitive galvanometer to the slide wire contacts of corresponding polarity. If the e.m.f. between the contacts is equal to the thermo e.m.f., there will be no deflection of the galvanometer. If, however, the e.m.f. is higher or lower, there will be a deflection of the galvanometer in one or the other direction. By changing the distance between contacts, using the galvanometer as a guide, the position at which the slide e.m.f. balances the thermo e.m.f. is easily located. One galvanometer serves both for measuring the current in the slide wire, in which case it is connected in multiple with a shunt, and for indicating balance, when it is connected directly in series with the couple.

A simple operation suffices to measure the temperature at the point where the thermo-electric couple has been installed. The e.m.f. of the thermo-couple is proportional to the difference in temperature between the cold couple and the hot one. The indication on the scale, however, is the actual temperature in degrees of the hot couple, as the setting of the lower pointer on the scale at the temperature of the cold couple (indicated by the mercury thermometer) mechanically adds this temperature to the pontentiometer measurement. A simple method of checking the apparatus is to make a direct comparison with a standard thermometer by placing the test couple, furnished with the apparatus, in an oil bath with the standard thermometer and comparing the potentiometer readings.

New Hubbell Reflector

The Hubbell line of 6½ in. parabola reflectors have holders so located that when the sockets are suspended in a vertical position the reflectors are at an angle of 30 degs. off the horizontal. By this arrangement the company claims that scientific tests have definitely determined that the concentration of light downward is best obtained. These shades may be had in aluminium, steel or brass. The aluminium and steel reflectors are finished green outside with matt aluminium of high reflecting qualities inside. Brush brass is the standard outside finish for the brass shades, with aluminium inside, but any special finish desired can be supplied. All are equipped with Hubbell standard contractile collar, which permits the rigid attachment of the reflector to the socket without the use of additional shade holders.

Hubbell parabola reflector.

Mr. Merowit Goes Over to Cutler-Hammer.

Mr. William G. Merowit has been appointed representative for Upper New York State and Eastern Canada on the Cutler-Hammer Manufacturing Company's line of motor controllers, lifting magnets, magnetic clutches, brakes, etc. For the present he will make his headquarters at the New York office of the company, Hudson Terminal, 50 Church Street, New York City, but will come up into Canada often, to take care of the Canadian business for the Cutler-Hammer line. Mr. Merowit was formerly power apparatus sales specialist with the Northern Electric Company, Ltd., Montreal.

Try It On Your Suit.

"Try It On Your Suit" was the effective slogan adopted by an electrical store pushing vacuum cleaners. The hose connection to a cleaner set up in the store window passed through a hole in the window casing out to the sidewalk and ended in an ordinary cleaner nozzle. A placard invited passersby to plaze the nozzle on their coats and watch the dust vanish. Many sales resulted.

Twin City Jovians.

The last monthly meeting of the Jovians of Fort William, which took the form of a dinner at the Victoria Hotel, was a more than usually interesting function. The guest of the evening was Dr. C. C. McCullough, who gave a very interesting address on electro-therapeutics, which was greatly appreciated by the company of electricians who formed his audience. H. W. Monahan, P.O. 13224, was chosen as the new first tribune of the local lodge, and a short talk was given by a visiting Jovian, L. F. Conrad, of the Northern Electric Company, Winnipeg.

Tablet to Lieut. Hague.

A tablet to the memory of Lieut. Owen Carsley F. Hague, of the 7th Battery, 2nd Artillery Brigade, who died from wounds on May 3, has been unveiled by Capt. M. McNaughton in the Church of St. James the Apostle, Montreal. Lieut. Hague, who was a B.Sc. of McGill University, joined the overseas forces with the first contingent, resigning his position as electrical engineer of the John S. Metcalf Company, Ltd., Montreal.

Toronto Electrical Contractors' Dinner.

At the regular dinner of Toronto electrical contractors, held in the Carls-Rite Hotel on the evening of Jan. 24, the speaker was Mr. Scott Lynn, factory manager of the new Canadian factory of the Sangamo Electric Company. Mr. Lynn gave the members a general talk on metering devices, their history and application, illustrating by a number of actual samples. Brief addresses were also delivered by Mr. R. A. L. Gray and Mr. Carty, who were present for the first time and expressed their pleasure at the evident spirit of co-operation existing among the Toronto electrical contractors, which augurs well for the future of the electrical business in the city. The next dinner will be held at the Carls-Rite, on Feb. 14, 7.30 p.m. If by chance the committee fail to get in touch with any contractor, he is requested to accept this notice as a cordial invitation to be present at the next dinner.

Personals

Mr. Charles Cassils has been elected vice-president of the Bell Telephone Company, in succession to the late Hon. R. Mackay.

Lt.-Col. Frederick Nicholls, president and managing director of the Canadian General Electric Company, Toronto, has been appointed to the Senate.

Mr. N. R. Norman, former sales representative in New Brunswick for the Northern Electric Company, Limited, is now in England with the Imperial Aviation Corps.

Captain R. F. Morkill, signal engineer of the Grand Trunk Railway, commanding the 209th Field Company, Royal Engineers, has been promoted in the field to major of the Royal Engineers.

Mr. Charles T. Nisbet, for several years superintendent of the Sussex Electric Light Company, Sussex, N.B., has been appointed sales representative for the Northern Electric Company, Limited, in New Brunswick.

Current News and Notes

Alton, Ont.

The ratepayers of the village of Alton, Ont., recently carried a by-law authorizing an agreement with the Hydro-electric Power Commission of Ontario.

Athens, Ont.

The electric lighting plant at Athens, Ont., was recently destroyed by fire, as was also the local telephone exchange.

Chatham, Ont.

Mr. Stanley Latimer, travelling superintendent of the Ontario Hydro-electric Power Commission, received a shock at 26,000 volts while examining a switch at the Kent substation, Stratford, Ont. He will recover.

Hamilton, Ont.

Mr. Geo. E. Willis, Hamilton, Ont., has opened an electrical supply store in the Spectator Building. He will handle a complete line of electrical fixtures and household accessories.

Kitchener, Ont.

The net profit of the Kitchener-Waterloo Street Railway, Kitchener, Ont., for the month of December, 1916, was $993. A total of 119,095 passengers were carried, constituting the largest number for the same month since the road has been in operation.

Lyall, Man.

Work on the electric lighting system at Lyall, Man., will be held in abeyance until spring.

Montreal, Que.

The Phoenix Electric and Manufacturing Company, Montreal, Que., have registered.

In our last issue it was stated that the Duncan Electrical Company, Limited, Montreal, had obtained a charter. It should be explained that this is a new charter, with a capital of $150,000, the firm having been established many years.

According to a report from the City Attorney of Montreal, the Council have no power to compel companies holding federal charters to place their wires in the underground conduits. It was suggested that an order be obtained from the Railway Commission, but the controllers have decided to first consult the Electrical Commission. The telegraph companies are the concerns affected.

It is admitted that the Montreal Tramway Company's service has not lately been satisfactory, but Major Hutchison, the general manager, explains that it is due to an unusual amount of traffic at the rush hours, principally of munition workers, and that the company are making strenuous efforts to overcome delays. A new auxiliary steam plant has been ordered, three additional sub-stations contracted for, and an underground conduit system constructed. Unfortunately, the equipment has not been delivered on time, and the measures to meet this extra traffic, which was foreseen, have not come into operation. Col. F. W. Hibbard, the chairman of the Quebec Public Utilities Commission, states that he is investigating the matter. "The partial failure in service is due simply to lack of power. The source of the company's supply is almost entirely hydraulic, and the winter conditions have seriously affected this. The company is making every possible effort to overcome the shortage and instal an auxiliary steam plant. As to the responsibility for such a plan not having been installed before, there is not sufficient data to express a definite opinion. It is fair to say, however, that if the company's contractors had kept their engagements it would have had the power to-day.

Nelson, B.C.

In the annual statement for 1916 of the Nelson, B. C., electric light and power department, profits amounting to $10,976 are shown. Receipts for the year totalled $59,369.

Niagara Falls, Ont.

The United States House of Representatives on January 1 authorized the temporary use of water-power at Niagara Falls up to the limit (20,000 sec.-ft.) allowed by the treaty between England and the United States, namely: an extra 4,400 cubic feet per second. The urgent need for further power is given as the immediate reason for this move.

Port Arthur, Ont.

A by-law has been passed by the ratepayers of Port Arthur, Ont., authorizing the Hydro-electric Commission of Ontario to proceed with the Dog Lake development. The estimated expenditure is $2,500,000 for an output of 30,000 h.p.

Sackville, N.B.

Mr. C. F. Fawcett, Upper Sackville, N.B., is installing a private electric lighting plant. The dynamo, which is of English make, will be driven by a gasoline engine, and light will be supplied to several farms in the vicinity.

Sarnia, Ont.

The Sarnia Board of Trade and the city council have requested the Sarnia Street Railway Company to carry out certain improvements in their cars, including the lowering of the steps and installation of air brakes. It has also been suggested that a belt line be established around the city. Advance information seems to indicate that the company will take some action along the lines mentioned.

South Vancouver, B.C.

By shutting off all street lights in South Vancouver, during the past year, at 1 a.m., a saving of over $8,000 has been effected. It is now suggested that, in order to overcome the early morning darkness in winter months, the lights be shut down at 12 p.m. and turned on from 6 a.m. until daylight.

Stratford, Ont.

The report of the Public Utilities Commission of Stratford, Ont., for the year 1916, showed a net profit of $4,104. The total earnings were $74,931. The number of services supplied is 2,624, including 65 in the village of Sebringville.

Toronto, Ont.

On January 16-18 a conference of the head office, divisional and district officials of the Bell Telephone Company was held in Montreal when questions relating to management, organization, etc., were discussed.

Trade Publications

Graphic Meters—Catalogue No. 369, issued by the Esterline Company, Indianapolis, Ind., completely illustrating and describing Esterline graphic efficiency instruments.

Inter-Communicating Telephone Systems—Bulletin No. 1017, by Stromberg-Carlson Telephone Manufacturing Company, Toronto, describing and illustrating the various types of inter-communicating telephone systems supplied by this company.

Automatic Safety Disconnecting Hangers—Booklet issued by the Thompson Electric Company, Cleveland, Ohio, illustrating and describing the Thompson automatic safety disconnecting hanger for lowering lamps without bringing down the wires also. These hangers are particularly suited for mazda type C and nitrogen lamps, though strong enough for arcs and flood lamps.

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An Engineering Society to Include all Canada's Technical Men

The Canadian Society of Civil Engineers appears to be divided at the moment between what has been called an ultra-conservative party or section, composed of members, it is claimed, who are anxious only to preserve the ancient name and traditions of this society—quite ignoring the developments of the past quarter-century in the engineering world—and an aggressive party who are working for a reorganization along lines more compatible with modern thought and practice. One of the main points at issue is the dropping of the word "civil," so as to make the name read "Canadian Society of Engineers," or "Canadian Institution of Engineers," and, along with this, a broadening of the boundaries of the organization so as to include, on practically an equal footing, civil, electrical, chemical, mining, and mechanical engineers, presumably as branch organizations of the parent society.

In favor of such a change it can be said that within narrow limits the word "civil," at the time of the organization of this society thirty years ago, was understood to include all kinds of engineering, which broad interpretation has gradually disappeared, however, as the other branches of engineering have developed. It could thus be argued that in dropping the word "civil" the new name would merely represent what the originators of this honored organization intended it should represent.

There are other arguments too, doubtless, that must have more or less bearing on the subject. Take the electrical engineers for example. Failing a strong parent organization of Canadian origin, the electrical men have, very largely associated themselves with a foreign society. The same is true of other branches, and this would seem to indicate, if nothing else, that the various engineering branches in Canada are not yet numerous and powerful enough to support separate Canadian societies. They should, however, be able to support one such, and the scheme which seems to offer the best promise of being of the greatest good to the greatest number is the change now being advocated for the Canadian Society of Civil Engineers—that is, make it a Canadian society of engineers, and let it be governed by a board of representatives, elected by all the branches of the engineering profession in Canada, who should have equal standing. This surely means unity, and units means better organization and more effective work.

Will Report on Montreal Aqueduct

After many months of discussion, there is a prospect of the controversy over the Montreal Aqueduct and the proposed hydro-electric development being settled. At the suggestion of the Board of Control, the council have voted $5,000 fees for the services of Mr. J. B. McRae, consulting engineer, Ottawa; Mr. H. E. Vautelet, former Chairman of the Quebec Bridge Commission; and Mr. Arthur St. Laurent, assistant Deputy Minister of Public Works, who will examine and report on the project. The council of the Canadian Society of Civil Engineers and thirty-one ratepaying engineers, have strongly criticised the scheme as being unduly expensive; as unlikely to develop more than seven thousand horse power, in place of the ten thousand horse power for which it is designed; as uneconomical, in that power can be purchased cheaper than it can be developed under the scheme; and as unsound generally in view of the probable stoppage of the plant by frazil during a part of the year. It was therefore suggested that an independent board of engineers be appointed to examine the project.

Mr. P. Mercier, the city's chief engineer, in an elaborate report, defended the details of the scheme, and denied that the plan was defective on the points alleged, and contended that the city could not afford to gamble on the problematical future cost of electric energy, when it could, at the actual market prices, possess its own water power and street lighting system at a lower cost, or even at the same cost, and be totally independent of any probable future power trust. Mr. Mercier opposed the suggestion that the scheme should not be carried to completion—($5,200,000 is the estimate of the cost already incurred)—and states that it would cost the city more to abandon the scheme than if it were completed and the city owned its street lighting system. The chief engineer, however, while recommending that steps be taken to carry out the entire plan, also asked for the appointment of a board of three outside experts to examine the various reports, particularly those of the opposing engineers and his own, and also the plans—to that extent he is in agreement with the critics. Mr. Vautelet and Mr. McRae are members of the Canadian Society of Civil Engineers, but have not taken part in the discussion.

Business Preparations for Peace

The necessity for business preparedness was the subject of an address by Mr. R. J. Yonge at the Montreal electrical lunch on Jan. 31st. Canadian business men, said Mr. Yonge, are totally unprepared for competition in the world's markets should hostilities come to an end at an early date. As the leading business men of the country were not at the front, they should give serious thought to the question of after-war trade, upon which the welfare of the people depended. All the important business and industrial concerns should confer and plan for the future. There were 600 factories in Canada, employing 400,000 people on munitions and other war work, and he asked what was to happen to these people when the war orders were cut off, and what, also, would become of the returned soldiers, and what of meeting the great national debt? These questions, if not attended to immediately, would have a very serious effect on the country. Every effort should be made at once to place Canada in a position to compete, after the war, in the world's markets. Mr. Yonge then referred to the great trade federation of the Allies to build up trade and to pay off the national debts. When war ceased the world would be hungry for manufactured articles. The supply and stores in Great Britain and other countries had been depleted, and no time could now be spared for their manufacture. Canada could play an important part in restoring this supply. Great Britain, of all the Allies, was the greatest manufacturing nation, but even she would not be able to meet all the requirements immediately after the war; the greater part must come from this side of the Atlantic. While the United States were preparing for after-war conditions, Canada was doing nothing, and it was time that action be taken to make known our resources to the allied countries.

Certificates Now Available

The War Savings Certificates of the Dominion Government are now on sale. Three-year $25 certificates can be bought for $21.50; $50 for $43, and $100 for $86. Thus the interest return is slightly over 5 per cent. compounded. These certificates offer the first opportunity that has ever been given the small investor to purchase a government security offering anything like this rate of interest, and the man or woman who buys and thus places his savings at the disposal of the government may not only feel that he is having a direct share in feeding, equipping, and munitioning our Canadian soldiers, who are so nobly doing their part, but that at the same time he is placing his money most advantageously.

B. C. Telephone Co. Statistics

As an indication of the greatly improved business conditions in Vancouver and the province in general, the officials of the British Columbia Telephone Company state that the number of telephones in use in the city on Dec. 31, 1916, was only 500 below the record. The total number in use during the period of greatest prosperity was about 25,000, but it dropped to 19,000 odd during the slump. At the period of greatest depression the company was removing an average of 60 phones daily and installing about 20; now about 20 are being removed as compared with an average of about 40 installations per day. The indications of better business conditions lead to the assumption that the number of instruments in use in Vancouver will soon reach and possibly pass the old record number.

Progress has taken place in every district of the province in which the company operates, which is from Port Alberni, on the west coast of Vancouver Island, to Nelson and other points in the Kootenay. During the year there has been a net gain of 2,534 telephone stations, distributed over the 42 exchanges. The largest gain was in Vancouver, which amounted to just over 1,200; Victoria, 266; Nelson, 102; New Westminster, 100; North Vancouver, 90; Trail, 77; Nanaimo, 30; Port Alberni, 21; Port Coquitlam, 16. It might be claimed that in the matter of telephone stations the province is back to where it was on August 1, 1914, when war started. On that date the British Columbia Telephone Company had 42,418 telephone stations. Gradual decrease followed, until Nov. 1, 1915, when the figure was 39,535, or less than 3,000 of a total decrease. Since that date there has been continual net gains, and to-day the number of stations is 42,337, or only 71 behind the record mark. The total net gain for the whole territory in 14 months is over 2,500.

Putting it in figures, the British Columbia Telephone Company placed during the past year nine and a half million feet, or about 1,800 miles, of wire conductors in cable only; about 2,700 poles, or 67 miles, exclusive of long distance construction, were set; underground conduit laid amounted to 14,000 duct feet; 3,000 feet of underground iron pipe laterals were laid underground; 225 miles of iron were stretched, principally in the rural districts.

Montreal Electrical Society Speakers

The following speakers and subjects have been arranged for the weekly luncheons of the Montreal Electrical Club:

February 21, Mr. A. D. Thornton, Canadian Consolidated Rubber Company, "Rubber."

February 28, Mr. J. Hughes, C. P. R., Electrical Engineering Department, "Electrical Problems in Railway Terminal and Distributing Points."

March 7, Mr. H. Hulatt, manager of Grand Trunk Telegraphs, "Time Service."

March 14, Mr. L. McMahon, Bell Telephone Company, "Ireland as a World Influence."

March 21, Mr. Brown, Canadian Westinghouse Company, "Air Brakes."

March 28, Mr. J. A. Beaudry, Retail Merchants' Association, "The Value of Service to the Public."

April 4, Mr. B. Wheelright, Grand Trunk Railway, Signal Engineer.

April 11, Mr. Mullahy, Canadian Consolidated Rubber Co., "The Place of the Medical Profession in Modern Industry."

April 18, Mr. H. E. Howe, Arthur D. Little Company, "The National Resources Survey."

Gzowski Medal Awarded

The Gzowski medal of the Canadian Society of Civil Engineers has been awarded to Mr. H. Holgate, consulting engineer; Mr. Julian C. Smith, chief engineer and general manager of the Shawinigan Water and Power Company, and Mr. R. M. Wilson, chief engineer of the Montreal Light, Heat, and Power Company, for their paper on the Cedars Rapids manufacturing development. Mr. Smith also held the medal in 1913, for his paper, "Design of High Voltage Transmission Lines," and Mr. Holgate, in association with Mr. R. A. Ross, in 1907, for papers on the "Huronian Company's Power Development" and "Power Development on the Kootenay River for the West Kootenay Power and Light Development Company, Limited." Only one other member has held the medal on two occasions.

Nearly 300 Miles of Railway on Glass

Two large illuminated maps of the British Columbia Electric Railway system have been installed at each side of the Carroll Street entrance to the company's handsome station in Vancouver. Each sign is five feet high and ten feet long, made of heavy glass, and the pair show the city, suburban, and interurban lines, the New Westminster system, and the power plants of the company. The railway lines appear in red, the land in black, the station names in white, the sea in blue, and the parks in green. The maps furnish an excellent idea of the extent of the system on the Mainland, which comprises 285.97 miles of track, of which 102.07 miles are in Vancouver.

Iron and Steel Conductors for Use on Branch Lines

Meeting with Favor on Account of High Cost of Copper and Aluminium—Some Interesting Curves Showing Characteristics Under Varying Conditions

By H. B. Dwight*

The increasing use in overhead electrical lines of wires and cables of iron instead of copper is to be accounted for by the high prices of metals and by the growing knowledge of the properties of iron conductors, which enables them to be specified with some confidence as to the results. It has been found that iron or steel can compete with copper on branch lines, but generally not on main lines where the electrical loads are heavy.

In order to show some of the possibilities of steel conductors, a group of test curves of steel wires and cables of medium grade, at both 25 and 60 cycles, is given in Figs. 1 to 5. The curves bring out the fact that cables have far less skin effect than solid wires, and, so, large steel cables can be economically used for alternating currents where solid wires would be out of the question. The curves also show certain characteristic facts about the effect of the stranding and spiraling of steel cables which indicate precautions to be taken in the choice of such conductors. These typical curves cannot be used in the design of practical lines, for small changes in the grade of the steel make large changes in the electrical characteristics, and so it is necessary to have tests made of the actual grade of conductors to be used in any case.

Perhaps the best way of proving that iron and steel conductors are profitable under at least some conditions is to give a list of some of the companies using them, as mentioned in the technical magazines:

Texas Power and Light Company—9/32 in. steel cable on a 22,000-volt line.

Otter Tail Power Company, Minnesota—No. 4 iron cable on a 40,000-volt 20-mile line.

Georgia Railway and Power Company—No. 4 iron wire.

East Haddam E. L. Company, Mass.—No. 4 iron wire.

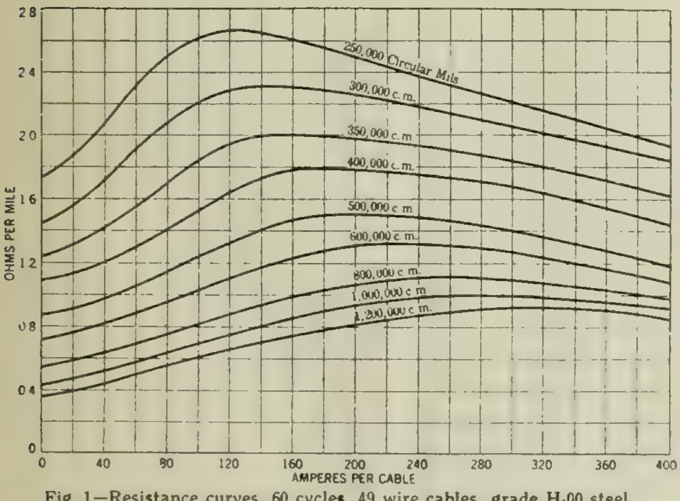

Fig. 1—Resistance curves, 60 cycles, 49 wire cables, grade H-00 steel.

United E. L. and W. Company, Conn.—No. 4 iron wire.

Nebraska Gas and Electric Company—7/16 in. iron wire.

Pacific Gas and Electric Company, California—No. 6 iron wire.

Monmouth Public Service Company, Illinois—No. 6 iron wire.

Pacific Power and Light Company, Washington—No. 8 iron wire.

One company, in an effort to get away from the high cost of copper, has used No. 8 copper wire, but this use is rare, as No. 8 copper is mechanically weak and No. 6 copper wire is the smallest size usually used for overhead work.

The way in which these companies have found iron profitable is shown by taking a sample seven-mile line. Copper wire of the smallest permissible size would cost $2,600, but if the electrical load is small, iron wire costing about $250 can be used, thus saving more than 90 per cent. of the conductor cost.

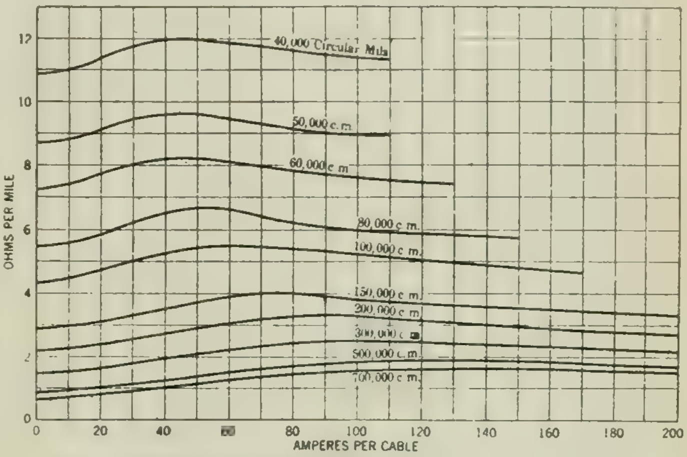

Fig. 2—Resistance curves, 60 cycles, 19 wire cables, grade H-00 steel.

If criticisms of the choice of conductors in the above list were to be made, they would be that cable is preferable to wire, except for the very smallest conductors, and that an expensive grade of pure iron telegraph wire was used in several cases. According to the descriptions, this had a low direct-current resistance, but the a.c. resistance increased to three times the d.c. resistance. Probably cheaper material would give better a.c. conductivity.

It is well known that the effective resistance of an iron conductor is very much greater for alternating current than for direct current. This is due to both current distortion and iron loss. The current produces a magnetic field inside the conductor, and this field is usually strong because of the iron path for the magnetism. This alternating magnetic field, which is often several hundred times as strong as in a copper conductor, is in circles around the axis, and it generates e.m.f.'s, which force the current away from the centre of the conductor and so increase the I^2R loss. Moreover, the magnetism in the iron produces hysteresis or iron loss. The percentage increase in power loss, or in effective resistance for a certain current, is referred to in this paper as the percentage of skin effect, and it includes all extra losses.

The resistance curves in Figs. 1 to 5 indicate that it is probable that fairly large steel cables can be economically manufactured which will have only 60 or 70 per cent. increase of resistance at 60 cycles and less than half that amount at 25 cycles. This would be much better than is sometimes being used in America at present, for even some of the small conductors have 200 per cent. increase, and skin effect is rapidly multiplied with increase of diameter.

There are three main methods for reducing skin effect. First, the iron or steel should not be too pure, for then the permeability to magnetism is very high; lower grades have out down the magnetism which is in circles around the axis. Third, as little spiraling as possible should be used, and the sometimes less cost and at the same time higher a. c. conductivity. Second, the conductor should be a cable made of moderately fine wires, for the air spaces between the wires

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*Before Toronto Branch A.I.E.E.

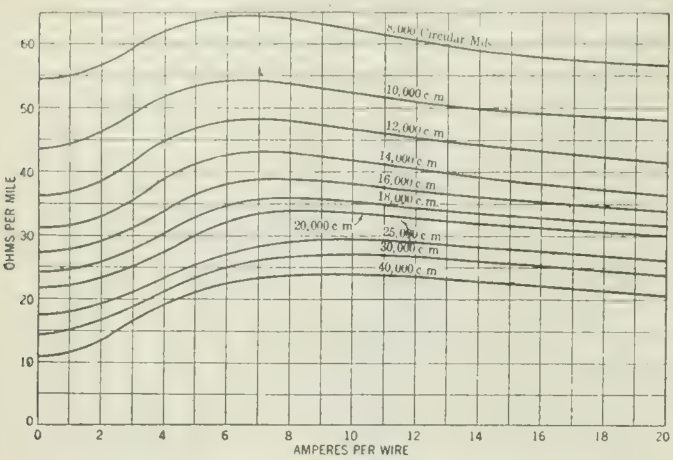


Fig. 3 Resistance curves, 60 cycles, 7 wire cable, grade H-00 steel.

different layers or groups of wires should be spiraled in opposite directions. The magnetism caused by spiraling runs parallel to the axis, and so encounters practically no air gaps. The surprisingly large effect of reversing the spiraling is shown in Fig. 6.

A question which is of as much practical importance as that of skin effect is whether the very cheapest grade of galvanized steel cable, selling at about one-tenth the price of copper cable, can be used for conductors. Practically no data whatever have been published on this question, and, as the necessary tests are simple and comparatively inexpensive, it seems proper to urge the making of this piece of useful research.

The tests can be made with commercial apparatus in much the same way that the characteristics of a transformer are measured. Curves should be taken of the resistance ohms and reactance ohms for various currents, including heavy currents past the maximum peak of the curve. An outdoor single-phase circuit should be put up, consisting of as much as 1,000 or 2,000 feet of wire or cable, for the larger sizes. A spacing of one foot or more should be used to avoid proximity effects.

One disadvantage of galvanized steel conductors is that

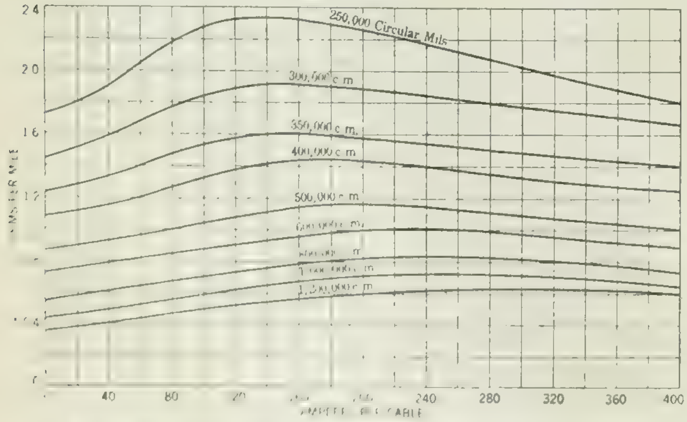


Fig. 4 Resistance curves 25 cycles, 19 wire cables, grade H 00 steel

they do not last as many years as copper ones, especially in large cities or near the sea coast. Tables which show the probable life of galvanized iron wire presumably refer to experience with small telephone or telegraph wires, and show a reasonably long life of 15 or 20 years in country districts away from the sea coast. It is possible that large cables may have a longer life than small wires, and, on the other hand, it is possible that cheap grades of steel may have a short life. The question of the long life and high scrap value of copper must be taken into account in any comparison of steel and copper, and is one reason for confining the use of steel to cases where copper is at a disadvantage, such as the case described above, where the required copper cost ten times as much as the steel.

Since corona, as well as mechanical strength, prohibits the use of a smaller conductor than about No. 0 (0.325 in. diam.) on a 100,000-volt line, steel cables can be suggested for use on branch lines of this voltage, if precautions are taken to reduce the skin effect. Such a steel cable could have a large enough diameter so that there would be no danger of corona, and it would have sufficient conductivity for comparatively light loads, such as are often profitable to supply through small 100,000-volt substations.

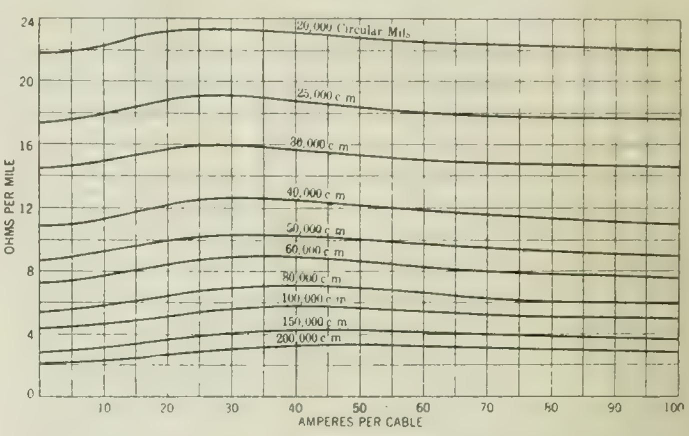


Fig. 5—Resistance curves, 25 cycles, 7 wire cables, grade H-00 steel.

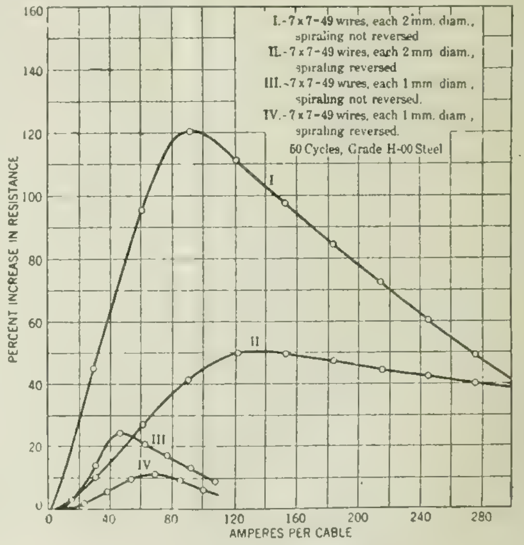


Fig. 6—Effect of spiraling.

On such lines the peculiar increase of resistance and reactance of steel cables with heavy currents would limit short circuit currents more than copper conductors would do, and so the steel conductors would act in a similar manner to current-limiting reactance coils. It is found that in most cases the steel conductor is working on the rising part of the resistance and reactance curves at normal load, and is near the maximum point under short circuit conditions.

There is a possibility that low-priced steel may be found, when the tests are made, to have good enough conductivity to compete directly with copper for use in overhead feeders on direct-current railway systems. As the cost of the conductors is the largest item in the line cost, the increased cost of insulators and poles due to the extra weight of the steel cables can be compensated for by a percentage saving in the cost of conductors. Here, also, the increase of resistance at times of short circuit would be useful, as it would tend to protect commutating machines from flash-over.

Steel trolley wires are not much used, partly due to the fact that the wires are subject to wear, and so cannot be galvanized or otherwise protected from rust.

For very long spans, such as river crossings, on main transmission lines or branch lines, steel cables, or copper-clad steel cables, have always been standard practice, since pure copper has not sufficient mechanical strength. The electrical characteristics are not of much importance in choosing a conductor for a single span, which is only a small part of a long line.

Public Service and the Central Station

The Policy to-day Contrasted with Ten Years Ago — Salesmanship is 75 per cent. Service and the Balance Product

By Mr. T. R. Hay[*]

A changed life, a highly specialized life, has come over this country. From an agricultural and provincial community of great distances and with few outside interests, we have grown into a manufacturing community of the first magnitude, and we are now fairly settled in a mechanistic and industrial age that increasingly makes for the submergence of the individual by the exaltation of the machine.

Economic problems of supply and demand, of barter and trade, together with many other special problems having to do with this new life are present in pressing magnitude and force. The most vital of all present economic problems are the relations between the public and the public service utilities, particularly those of interchange and intercourse. As movement is life, so are intercourse and interchange the true basis of civilization and commerce.

One ever present problem and responsibility is the securing of the best method to realize the proper maintenance and the further extension of the public utility The maintenance and continued development and growth of the country will in a great measure be dependent upon the maintenance and continued growth of the utilities which furnish these facilities for intercourse and interchange. All other utilities or industrial or commercial enterprises are subordinate to and dependent on these fundamental, underlying phases of our industrial life. Without the public utility, such as the railroad, the telephone, the telegraph, etc., with vast resources of money and men, the development of the economic possibilities of this country would have been slow and greatly retarded. The application of these vast resources of men and money has resulted in discoveries, inventions and developments that have brought into everyday use facilities which only recently had been out of reach of all but the favored few. Without these concentrated resources the economic developments realized would have been out of the question.

The Old Policy of Utilities

In the possession of these vast powers it is not to be wondered at that often men acted unscrupulously and with regard only for their own welfare. The public was seldom considered as anything but a willing suppliant without privileges, rights or immunities and bound to be thankful for any crumbs that might come into its way. All was right and fair as between those in the places of power, but the public was not expected or entitled to any expression of resentment, of difference, or of rebuke. Now all this is changed and the public is in the saddle, and in some cases tends to the extreme formerly occupied by the public utility Competition, control, regulation and legislation are looked on as the forces which have enabled or compelled industrial enterprises to improve and extend their service; to increase production; to pay increased wages and taxes; and at the present time to decrease the charges for service rendered. While these features have been, to some extent, a stimulus, the wonderful improvement which has been made has been coincident and indissolubly connected with the replacement of the old wasteful methods by the new methods of scientific operation. Investigation, research, and the application of the results to both operation and production have made possible a larger production from the same or less effort and expenditure, and have obtained valuable products from what had formerly been wasted.

All this economic improvement has been much to the benefit of the worker, by making for shorter hours, more pay and better working conditions; to the public served, by reducing the cost of necessities, by making life easier and more pleasant to live, and by bringing into the market necessities and luxuries of benefit and value; and to those responsible for the work, by making their incomes larger, by enlarging their field of operation, and by making it possible for the producer to have some personal share in the bringing of greater happiness and joy to life. But through it all there is a lack of consistency in the understanding respecting enterprise and initiative, and the relations between capital and labor—the employer and the employee. There are many ideals and beautiful theories which in time may be realized. But commerce and industry are dependent on the purchaser and the consumer, and so long as the human factor of self-interest, as it now exists, controls them in their dealings, so long must the effect of that same existing human factor be taken into consideration by commerce and industry in their relations with both producer and worker.

Position of the Central Station Today

Public service enterprises are always large employers of labor and large purchasers of all varieties of products and manufactures. Their activities always contribute to the circulation of money, to employment, to production, and to consumption. In this continuous process of conversion from the raw product to the finished material, all public utilities necessarily have a very real part and interest, and in the fulfilment of this fact the public utility necessarily is continuously in contact with the public as buyer or seller, producer or consumer, or as labor.

One of the important contributing factors to this state of affairs has been the practical development and application of electricity in its manifold forms to the industrial uses of the community. Coincident with and because of this development has been the birth and growth of the central station, and by central station we mean a plant or a group of plants capable of supplying the needs and fulfilling the requirements of a community or communities, whether centralized or scattered over a given territory. In supplying such service and in fulfilling the requirements of the user, the central station naturally comes often into intimate relations with the user. In agreeing to supply such service there is the obligation on the part of the central station to give the most

[*] Duquesne Light Co., Pittsburgh, Pa., in Electrical Review.

efficient and the most continuous service possible at a fair rate of return. And there is the reciprocal obligation on the part of the user or public to realize that the central station is endeavoring to furnish the most efficient and the most continuous service possible, and to allow it to charge such a rate as will enable it to maintain and operate a plant or system that is adequate to meet the requirements of the user or the public, while at the same time showing a fair and reasonable net return on the investment.

Not over ten or fifteen years ago the central station was not thought of as a public utility, and service was a matter determined by the management instead of by the public, as at present. Instead of the larger corporation and holding companies operating over definite areas and with definite and continuing policies, the central station usually served restricted areas in no definite and efficient manner, and with little regard to the rights and needs of the public. Initially the service was supplied for lighting only, and was available from dusk until 11 or 12 o'clock, p.m. No adequate conception of the value or of the manifold advantages of a power load, or of 24-hour operation, was had, and no particular effort was made to secure an industrial motor load. In proportion as the central-station management conceived and appreciated the value of this day load, in such a proportion was the central station aggressive in soliciting this class of business and progressive in its standards of equipment and service, until now a central station is rarely found that does not systematically cultivate this class of business, while at the same time continuing to develop and increase the domestic lighting business and to secure municipal illumination.

At first, central-station managements were slow to realize the possibilities offered by this new field and were somewhat reluctant to co-operate to the extent of reducing rates to a point where they would be at all comparable with the existing industrial business increased, and in some cases in spite of, rather than because of the management.

Application of Central-Station Service Unlimited

The initial users of central-station service were small operators, as it was not considered possible to sell this service to the large users. With the increasing efficiency of electric power plant generating equipment, and with improved methods of sales and distribution, it is now possible to supply nearly every type and size of plant with power at a cost comparable to or less than the cost of generating this service locally.

With the expansion of the central-station field and the application of its service to every use, the central station has become a public utility in every sense of the word. As such it has necessarily assumed the responsibilities attendant on the furnishing of continuous, adequate and reliable service at a fair price and without discrimination.

Before the true conception of right and fair methods and the establishment of regulating commissions, no published schedule of rates, no particularly systematized methods of doing business and no settled policies prevailed. The user or public was treated as the best interests of the central station dictated, and not according to the justice of the contention and the rights of the party or parties concerned.

A policy of laissez faire and the public be damned was followed, together with a peculiar system of rate-making similar to the old railroad methods of rebating, that favored the few who had power, either actual or potential, as against the array of smaller industrial users and lighting consumers who were expected to be glad to take what they could get and say nothing. With the advent of the regulating commission order has been gradually evolved from this chaotic and uncertain state by the standardization of rates and by compelling a standard of equality in treatment that favors none and serves all.

The central station exists because of the public, and it is on account of their close relationship as buyer and seller, and their mutual responsibilities of operating and regulation, that it is right and proper that they work harmoniously together to the common end, the sale and application of electricity to the real profit and convenience of both. And to this public the salesman, the line-man, the trouble-man, or whoever he may be is the central station. In all his relations with this public he must be courteous in treatment and urbane in deportment. He must continually realize and appreciate, to the fullest extent, the fact that consciously or unconsciously this public is judging the central station rather by what it knows of the central-station representatives, than by what the central station's particular aims and policies may be.

Consideration for the Public

To the average man electricity and its intricate, complicated and technical features are a closed book. The good will of all classes and conditions of men is always eminently desirable and helpful, and all members of the central-station organization have individually their peculiar responsibility to the public of right treatment and consideration; but more particularly the members of the sales department, whether lighting salesmen or power salesmen, counter clerk or complaint adjuster, as the duties of these particular men bring them into more intimate and continuous contact with the public than is the case of the members of the other more technical departments, such as the engineering, accounting and meter departments. The molding of public opinion and the determination of the individual and collective attitude of the public is peculiarly in the hands of the rank and file of the organization. Right treatment of all, regardless of social or business positions, can only be reflected in a favorable feeling on the part of the public and in the creation of a positive and favorable attitude of tolerance and forbearance under difficulties, and of broad-mindedness and consideration when additional privileges and immunities are asked for.

Always, selling is 75 per cent. service and the balance product. This service initially takes the form of guidance, through courteous and truthful advice, and personal supervision and interest after a contract has been negotiated. In times of operating troubles, in the settlement of complaints and in correct explanation of outages and any occasional trouble, the central-station employee can always be of great assistance in holding the business and of helping the customer.

Users of electrcity, whether industrial power or domestic and municipal lighting, rely absolutely on the continuity and sufficiency of this service for the operation of their plants or the illumination of their houses and streets, and it is and should always be the duty of the central-station management to anticipate growth by the purchase and increasing requirements of this public. Failure to do so can only result in great pecuniary loss and much inconvenience and dissatisfaction on the part of the public, with loss of prestige by the central station, as well as prejudicing and jeopardizing any goodwill that the central station may have built up in its community.

The city of Nelson made profits amounting to $10,976.49 in its electric light and power department last year, according to the annual report presented by H. P. Thomas, city electrician. Receipts, made up of sales of light and power, reached $59,369.32, while operating expenses amounted to $16,442.88. Adding interest, $17,750, and sinking fund account, $14,200, the total charge against receipts was $48,392.83, leaving the net profits as stated above.

Factors in the Cost of Hydro-electric Plants

Figures Vary Between $67 and $134 per Kw. with $290 as a Maximum— A Brief Discussion of the Regulating Factors

By E. V. Pannell, Assoc. Mem. I.E.E.

Any contribution on the subject of the cost of hydro-electric development must necessarily be of a far more general character than if dealing with other forms of power generation. The diversity of conditions surrounding the development of water power renders analysis difficult; it is nevertheless desirable in these days of economy to survey very carefully the economic limits of hydro-electric power, particularly as compared with the modern steam plant.

In reference to the capital cost of water-power development it has been stated that "whilst every hydro-electric development is a law unto itself as regards capital cost, it may be said that as a general rule only under unusually favorable conditions is the capital cost for development brought below $50 per h.p. ($67 per kw.). For ordinary sites and average blocks of power $75 ($100 per kw.) is a very reasonable figure, and $100 ($134 per kw.) is well within economic limits." (Report of the Hydro-elec. Power Commission of Ontario, 1912, p. 146). The late Mr. H. G. Stott, a profound student of power generation, gives the typical investment for a 20,000 kw. installation as $125 per kw., of which the turbines and generators cost $12. (Trans. A.I.E.E. XXXIII., p. 1158). Examination of such undertakings as are in any way comparable shows that although the capital investment may vary as widely as from $40 to $290 per kw. capacity, such undertakings may reasonably be grouped according to the figures above quoted.

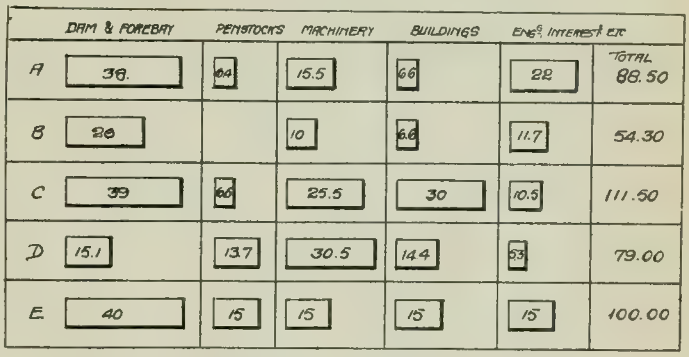
Very favorable conditions	$ 67.00 per kw. capacity
Good conditions	100.00 per kw. capacity
Fair conditions	134.00 per kw. capacity

The size of the plant upon which these figures are based is from 20,000 to 50,000 kw., although it may be said that water power installations do not show the same degree of economy with increasing size which is manifested by steam undertakings. For one reason the height of head developed has a large influence upon the cost, whatever be the output of the plant, and other factors external to the generating machinery are to a great extent independent of the size. In Fig. 1 the capital cost of four undertakings has been analysed into five separate factors:

1. Dam and forebay, including connecting flumes or tunnels and all preliminary dewatering, excavation, concrete, masonry and sluicing.
2. Penstocks and valves.
3. Generating machinery, including turbines with governors and regulating gates, generators including exciters, transformers, switchgear.
4. Buildings for power house, switch house, tailrace, etc.
5. Engineering, interest, contingencies.

Whilst apparently in no way consistent, these figures can be investigated with interest. Plant C shows an abnormally large investment on machinery which is due to the very large proportion of spare plant installed for emergencies. The item for buildings in the same scheme includes excavation of the power house in bedrock and the boring of elevator and cable shafts. The small output and head of Plant D, together account for the heavy cost of machinery per kw. In the estimated example E such unusual factors have been eliminated, the estimate being based upon the development of a 100-ft. head of about 30,000 kw. capacity in a reasonably good location.

Apart from such features as the contour of the drainage area, accessibility of the dam and power house site, the most important factors in the cost of development are the variation of flow and the head. Extreme variation of stream flow necessitates heavy construction costs for the dam, especially if continuous power is to be delivered at the switchboard, whilst the very low head scheme will usually call for a similarly costly dam because of the quantity of water which must be impounded or diverted. The bias is therefore in the direction of the higher heads where any choice is available, particularly as the present status of power transmission gives a radius of about 250 miles from the power consumer. Grouped with the dam costs are those for the conduits and forebay, which are all in some degree dependent upon the quantity of water consumed. The most pronounced influence of the head is exhibited in the cost of the generating machinery. Both the turbine and the alternator become increasingly difficult to design at low heads, whereas up to 700 feet there appears to be no upper economical limit provided large units be employed. Fig. 3 shows the relation of speed to head in modern large vertical single runner units. Before the present development of the vertical shaft single runner reaction turbine multiple runners were widely used on low heads with the idea of obtaining a higher and more economical generator speed. At the Korsnas power station in Sweden, where a six-foot fall is developed, eight wheels are employed on the same horizontal shaft in order to drive the 400 kw. alternator. A further device for the utilization of low heads is due to Jens Orten-Boving, and consists of two concentric shafts driving in opposite directions from different runners. The outer and inner shafts respectively drive the field and armature elements of the generator, thus doubling the effective speed. Such arrangements as this, whilst demonstrating the possibility of developing very low heads, are rendered obsolete in America by the present status of the large vertical shaft, single runner turbine, which gives a higher efficiency and a more simple unit than the multiple runner type, besides which the vertical arrangement renders it unnecessary for any part of the power house, exclusive of the turbine pit, to be below tail water level. These remarks are only applicable to the range of heads and outputs covered by the reaction turbine, as a totally different series



	DAM & FOREBAY	PENSTOCKS	MACHINERY	BUILDINGS	ENG^{G}, INTEREST & ETC	TOTAL
A	38.	6.4	15.5	6.6	22	88.50
B	26		10	6.6	11.7	54.30
C	39	6.6	25.5	30	10.5	111.50
D	15.1	13.7	30.5	14.4	5.3	79.00
E	40	15	15	15	15	100.00

Fig. 1—Diagram showing cost in dollars per kw. of modern hydro-electric plants:

Plant A	60,000 kw.	600 ft. head
Plant B	18,000 kw.	90 ft. head
Plant C	30,000 kw.	164 ft. head
Plant D	2,500 kw.	60 ft. head
Plant E (est.)	30,000 kw.	100 ft. head

of conditions, even to the employment of impulse wheels. (See Fig. 4). The actual cost of generating machinery for three different heads in geometrical ratio is shown in Fig. 5. For the 30,000 kw. estimated installation assuming that the items for dams and penstocks are independent of the head, the costs in somewhat greater detail are as follows:

	Head 25 feet	Head 100 feet	Head 400 feet
Dam, including dewatering, excavation, conduits and forebay	1,200,000	1,200,000	1,200,000
Penstocks and valves	450,000	450,000	450,000
Turbines 7 x 7500 h.p. governors and accessories	700,000	379,000	189,000
Generators 7 x 5000 kw. and exciters	385,000	281,000	196,000
Transformers and switchgear	140,000	140,000	140,000
Buildings and tailrace	60,000	50,000	40,000
	2,935,000	2,500,000	2,205,000
Engineering 5 per cent. Interest 5 per cent. Contingencies 10 per cent.	586,000	500,000	441,000
Total cost	3,521,000	3,000,000	2,646,000
Total cost per kw.	117	100	88

This, of course, is only an approximate estimate, but assuming that hydro-electric power can be developed at around $100 per kw. capacity, the above is a reasonable analysis of the proportional dimensions of the various items in the cost. For reasons already mentioned, the yardage of the dams on the higher heads is probably less than for the lower falls, but at the same time the site is probably less accessible in the former case and the penstocks will cost more. It was therefore thought best to accept the figures of $40 and $15 per kw. respectively for these two items. The machinery for the 30,000 kw. station, it will be seen, represents a total of 35,000 kw., there being one spare unit. Eliminating the external costs, the effect of the head upon the cost of power house and machinery is most pronounced, this item for the 400-ft. head costing only 43 per cent. of the same for the 25-ft. head.

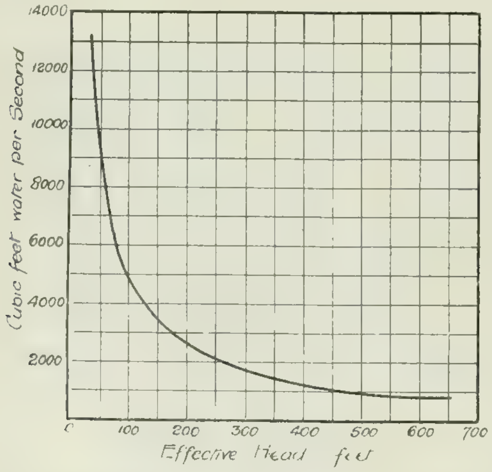


Fig. 2—Water consumption of 30,000 kw. plant at different heads.

In the majority of hydro-electric developments the cost of power generated is practically a measure of the capital charges. Fuel costs are absent and labor, supplies, depreciation and administration are independent of the quantity of energy produced. It is therefore much more necessary than in a steam plant to secure a good load factor in order to supply cheap energy. From published statistics ten to twelve per cent. of the investment represents good average practice in respect of the total of all such charges. With an installation costing $100 per kw., therefore, the cost of energy at the switchboard will be $12 per kw. year for a load factor of unity, or assuming a safe lower limit of 50 per cent. load factor the cost would be $24 per kw. year. In Fig. 6 is shown the cost of power for the 30,000 kw. plant already considered. Most water power plants supplying energy in industrial and agricultural districts operate with a load factor of around 60 per cent., with an irrigation load or electro-chemical industries this may be increased to between 70 and 80 per cent. A method of charge based upon the maximum demand is therefore vitally necessary for hydro-electric power in order to encourage such industries as will maintain a good annual load factor.

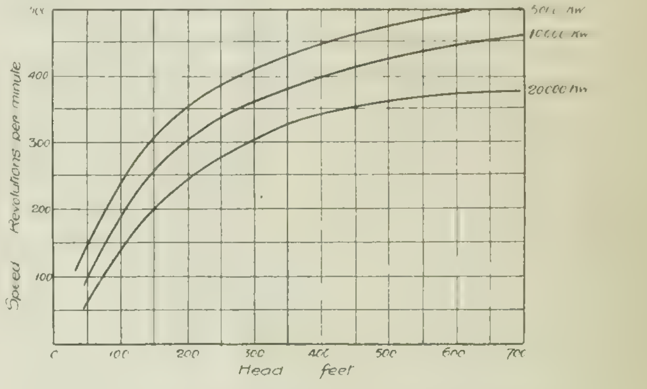


Fig. 3—Satisfactory operating speeds for single-runner reaction turbines and generators.

Few large hydro-electric undertakings supplying power to cities for lighting and railway operation have found it practicable to maintain efficient service without a steam reserve power station. Even where the flow of water is sufficient to guarantee the rated capacity of the installation being maintained night and day throughout summer and winter, and, as on the Pacific Coast, a number of hydro-electric stations are tied in with one another, the steam station is usually employed to provide a safeguard against interruptions on the transmission line. In a study of this matter as applied to Manitoba water resources one of the Dominion reports states: "It is not considered that such a plant would be required as an auxiliary in case of low water, but only as a reserve against possible accidents to the transmission line or power plant. In such case it is obvious that with proper design and precaution in respect of the transmission line and hydro-electric plant the reserve fuel-operated plant might be seldom required, possibly not for a year or more at a time."

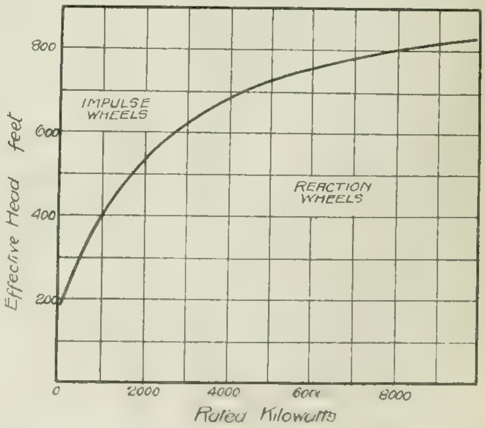


Fig. 5 Limiting heads and outputs for reaction turbines.

(Dept. of the Int. Water Resources Paper No. 3, p. 270). Where such plants are operated, however, it is evidently considered the best practice to maintain as uniform a load as possible upon the water power machinery and to utilize the steam station for carrying the daily peaks, besides having reserve capacity. This quite alters the complexion of any estimates prepared upon the basis of a water power plant pure and simple. The following table shows the relative capacity of water and steam plants upon systems employing both, the figures given indicating operating conditions as they existed around the beginning of 1916:

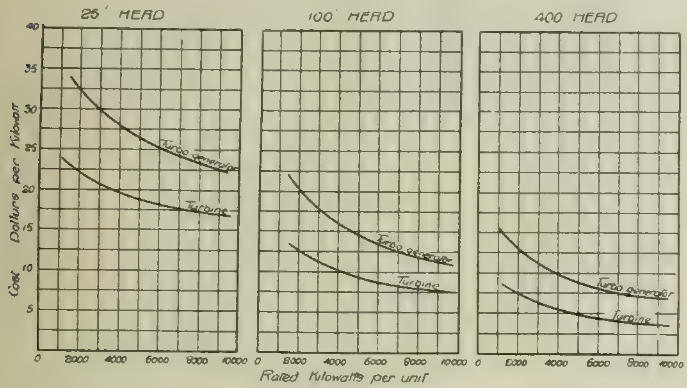


Fig. 5—Cost of hydraulic power station machinery at different heads and outputs.

	Hydro-electric Kw.	Steam Kw.	S/H%
Dominion Power & Transmission Company	21,800	5,200	24
Montreal Light, Heat & Power	34,000	7,500	22
Ottawa Electric Co.	6,520	1,500	23
Toronto Electric Light	80,000	20,000	25
Winnipeg Electric Railway	14,000	15,500	110
Canadian Light & Power	15,000	4,000	27
Pacific Gas and Electric	90,500	81,500	90
Great Western Power	56,000	32,100	57
Sierra & San Francisco Power	37,300	21,200	57
Oro Elec. Corp., California	3,000	1,000	33

From the above it will be seen that the average rating of the steam plant is some 47 per cent. of the hydro-electric installation. Assuming that an up-to-date steam generating station can be equipped for $65 per kw. the capital cost of the estimated 30,000 kw. hydro-electric plant would have to be increased by about $910,000, and the increase in the cost of energy as supplied would depend upon just how far the steam station was employed as a reserve or as an auxiliary. Until the advance in engineering practice can effectively combat the effects of lightning, blizzards and the deterioration of transmission line material the auxiliary steam plant must be seriously considered if a service of 100 per cent. efficiency is to be maintained.

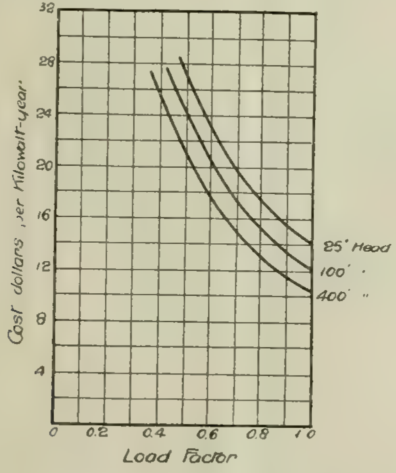


Fig. 6—Annual cost of power at the switchboard.

Telephones for Forest Protection—A Simple Installation, but Highly Efficient

Mr. R. T. Campbell, of the Northern Electric Company, contributed a paper on "Telephones for Forest Protection" at a conference on forest conservation held in Montreal on Feb. 1 and 2. The company had on exhibition a miniature installation of a forest telephone, together with the various materials employed. Mr. Campbell quoted at length from an article in the Electrical News descriptive of the Riordon Pulp and Paper Company's forest telephone system and of their experience, and continued:

"The construction of telephone wires in forests is a comparatively simple operation. It involves simply the preparation of a suitable clearing and the support of the wire from the trees. The general course of the telephone line has to be determined by careful consideration of all the uses it may have. In the portions which may be open the usual pole line construction method should be followed, using 25 ft. poles with 5 in. top, and standard brackets and insulators, the poles being spaced 40 to each mile. In the wooded sections the line should be constructed as near as possible to the established transportation way, having at the same time consideration for the general layout of the service to get the greatest usefulness. A clearing should be made for line wire. This clearing should be at least 4 ft. on each side, with 4 ft. above, and any small limbs which might be brought down by the weight of snow but which are higher than 4 ft. should be cleared. This operation will prove the most expensive part in the construction work, but with the experienced men of the companies should not be excessive. Any object which might cause later trouble to the line should be removed. Trees should be selected of average height and in staggered position, so that the wire will have a tendency to be drawn away from the tree rather than towards it. The tree support should be about 45 to 50 per mile, and should be attached to the trees 16 to 18 ft. from the ground; then, with a 4 ft. sag, a reasonable clearance from the ground will be obtained. The insulator supports should be made in a way that, should a tree fall across the line, the supports will give way rather than break the wire. This can be easily done by using a No. 12 wire wrapped around the insulator after it has been placed over the wire, then twisted and the end placed through an ordinary staple and turned back. The angle at which they are bent will determine the pull which is necessary to free them. This is one of the most important points in the construction of forest lines, and the care which is given to this will determine to a large extent the service and maintainence expense of the line.

"It is difficult to make any definite statement as to the cost of constructing a line through a forest on account of the many varying features of every installation. The material can be figured very accurately. At the present time the necessary wire and insulators for one mile of line could be laid down at any point in Quebec for less than $28. The transportation to location of the line, the clearing of the underbrush, pulling and supporting of the wire, tieing in and pulling slack will cost from $25 to $50 per mile. A good average would be $32, thus making the cost of the average forest line, with materials, $60 per mile. The telephone equipment will cost less than $20 per station completely installed, and it should be evident that the annual charge against the plant can easily be covered by allowance for the fire protection that it affords alone, as proved by the experience of the

Riordon Company. But what of the service that is obtained in the log drive, management, handling of cutting gangs, etc.? A comparison might be correctly made between the equipment and that of the regular fire alarm systems as used in the cities. The telephone, when thought of only as a means of fire protection, fulfils the same function as the street box fire alarm system. The properties of every city and town in Canada are protected by an elaborate system of fire alarm wires and boxes, the whole cost of which stands for protection against fire only. Wires must be run in conduits under the streets, and the whole plant is quite an elaborate installation, but in the forests the alarm system, consisting of a telephone and its open single wires, can be put to other work. Its efficiency as to means of lowering fire loss depends entirely upon the mileage and the location of the line with respect to a certain area. Any increased investment for extension as a means of further fire control means also an increased utility in the way of management, etc.

"The present time it is certain has brought to the forest operator, a shortage of men and houses, a problem as great as that of any other industries, and any means which will help in saving of time really has the same effect as an increase in the number of workmen. This one feature alone should add greatly to the value of telephone service in the forest districts. The development of a successful line of telephone equipment has not been arrived at by offering standard commercial equipment, but special equipment, such as the portable telephone, constructive methods, and other details, have received careful consideration, and the companies having requirements of such material can now at all times get assistance in helping to lay out the material they may require for an installation. Our experience with the different companies carrying on logging operations has been that everyone is more than willing to give the best co-operation to others in the same line, and I am certain that the various parties who have had telephone experience will always place information at the disposal of those wishing to make enquiries."

Helping the Solicitors

When a central station decides on a house to house appliance campaign, one of its biggest problems is that of obtaining solicitors. Electric appliance canvassers are not found drifting about, and it is therefore necessary to build them out of the best available material. The usual procedure is to advertise for agents or canvassers and to pick the best salesmen out of those who apply. One crew manager, who has successfully managed a large number of central station solicitor campaigns, characterizes the average green crew of canvassers as a "Bunch of Burglars," and he ought to know. This green crew must be educated, to make electrical salesmen out of them. Talks by the crew manager, sales demonstrations, daily or weekly experience meetings, these and many other means are used by experienced crew managers, each having his own particular method of instruction. Some of the "burglars" are dropped from time to time and new ones taken on as circumstances make it necessary.

It has been found that one of the hardest things to be done is that of educating a crew of canvassers in properly using catalogues. However, most manufacturers' catalogues are made to give all the information necessary in order appliances, and, necessarily, contain a good deal that is not required by the canvassers in selling the appliances. For this reason the Westinghouse Electric & Manufacturing Company has recently published a folder entitled "A Handbook for Solicitors." Five pages of the handbook are taken up with general sales arguments and pointers to solicitors, which are worth studying and remembering to make the best showing. Page 5 in particular gives a number of minor points, often overlooked by the average canvassers, which have been found to be of extreme importance. These are:

Always carry and leave a personal business card.

A user of an iron is a first-class prospect for some other device.

Spend half your call in explaining your device and the other half in getting the order signed.

Close your sample case while making a demonstration. This concentrates attention on what you are showing.

Don't mention price the first time asked—go on with your demonstration.

If asked a second time, a sale is pretty sure—stick for the order.

Make return calls in the evening if prospect wants to consult her husband—don't call the next day to see what he said—sell him yourself.

Don't leave articles on trial—it means double or triple work. Sell outright with absolute guarantee.

On Monday, Tuesday, and Wednesday, call at the back door; on Thursday, Friday and Saturday at the front door. This rule may vary with the neighborhood.

Rainy days are good days for industrial and apartment house calls, tailors, dentists, downtown—women don't want their rugs soiled.

Always ask prospects if they are satisfied with the company's service.

Turn in all complaints and see that they receive attention.

Advancement depends upon results. Best results from a central station viewpoint are those that build up the day load. This handbook is designed for use by progressive central stations about to start a canvassers' campaign, one for each canvasser employed.

It should be realized, however, that this book alone will not make sufficient canvassers out of a bunch of "burglars." It is simply a little pocket help which will assist in making appliance sales.

Nelson May Add Third Unit

The new City Council of Nelson is considering a recommendation left by the retiring body, to the effect that a third unit be added to the city power plant. At present the electric light and power load is such that both units are necessary to carry the peak loads, and it is pointed out by Superintendent Thomas that, should an accident happen to either unit, a portion of the present load would have to be dropped until repairs were made. An agreement has been entered into to supply to the French Complex Ore Reduction Company all surplus power remaining after supplying the citizens' needs, and this arrangement will give no chance for the overhauling of either machine until the new one is in place, about a year hence. By selling power by meter only it is thought the peak loads can be reduced sufficiently to keep the plant in operation until the new unit is installed, but no fresh customers can be taken on.

A by-law is to be submitted to the citizens of Sherbrooke, P.Q., in favor of purchasing the property of the Two This will include an undeveloped water power. The by-law provides for raising $500,000, which will enable the property to be purchased, a second unit installed, and a transmission built to Sherbrooke. Walter J. Francis and Company, of Montreal, reported on the proposal for the city, and estimate that the power to be developed from the present plant and the new unit will be 3,800 h.p., and with the inclusion of the undeveloped site the total will be about 10,000 h.p.

The Dealer and Contractor

Household Engineering—A term that suggests the modern home with its electrical equipment and its scientific management—A new idea come to stay.

"Household Engineering" is a new term born of the modern idea that there is as great scope for organization, skill and scientific methods in the home as in many of our businesses. It indicates both that there is work in the average household for the trained electrician in numerous little installations that are now becoming recognized as essential and also that there is need, on the part of the housewife, for careful and intellectual supervision of operation after these installations have been made. Especially is this true of the installations and uses of electrical equipment which is so satisfactorily replacing human labor. It would be folly to argue that electricity is fool-proof. It is merely an intelligent servant that must be handled intelligently. This fact, however, should be in its favor, for the constant complaint of the housewife is "mechanical drudgery." The strongest argument in favor of the use of more electrical devices, therefore, should be that they raise the intellectual standard of the work of the home.

An interesting article on "Domestic Engineering" appears in a recent issue of the Electric Journal, in which is also included detailed descriptions of numerous modern machines which are now commonly used in many households. We confine our extracts, however, to the general treatment, which, while possibly offering nothing that is absolutely new, does, nevertheless, say it in a different way. Mr. Bernard Lister, the author of the article, introduces the subject as follows:—

For many years farming, mining and manufacturing have been the principal industries of this country. In the carrying on of each one of these industries power is demanded in enormous quantities and is an appreciable item of cost of production. There has been an almost ceaseless effort toward increasing the efficiency of performing specific operations in these large industries, and much money has been spent in determining how to farm, mine and manufacture more cheaply by employing methods and machinery that will more completely displace hand labor, which is becoming continually more costly.

In the mining and manufacturing industries, however, large values of product are handled in restricted areas and much power is utilized over a very small space where a large number of men are usually employed. Thus in these industries the engineer could easily visualize and calculate the benefits of labor-saving devices and the substitution of electric power for other forms of power. Farming, on the other hand, exists in comparatively small units distributed over a very large share of the country, and although the cost of power is a considerable item in the cost of the product, it is utilized in comparatively small units at different times and different places. Consequently, this industry has in the past not appealed to the engineer as readily as the other industries named, and the large number of small producers have not received the same benefits in the use of labor-saving devices and the substitution of electric power as have the large industries of mining and manufacturing.

The Fourth Industry

A similar condition has existed in the fourth large industry, if it may be classified as such. If the home be considered as an institution for the production of "household service" this industry in itself becomes one of the largest of industries, if not the largest industry of all. Since mechanical power can usually be substituted for hand power wherever a simple duty is repeatedly performed, and since this condition exists in the industry of household service, there is an enormous demand for power in this field. Furthermore, since such power must be available at any of several points in the home and must be developed economically and quietly, the small electric motor satisfies the demand in a wonderful way.

Domestic engineering is therefore a very large and important branch of engineering, and it involves the solution of difficult and important problems. Many hand or foot operated devices have been invented, such as the washing machine and sewing machine, to save labor, and within the last few years the successful development of commercial small motors has created a situation where hand and foot labor can be eliminated very largely. In the process of household service there are performed repeatedly such operations as sweeping and cleaning, the washing of dishes, the washing and ironing of clothing, the cleaning of silverware and brasswork, the sewing of clothes, etc. These duties when performed by electrically-driven devices greatly increase the efficiency in this particular industry.

Increased Cost of Labor

The increase in the cost of domestic labor is a well-known fact. During the last ten years this cost has probably doubled. In the domestic field there is an increasing tendency toward shorter hours, and even a specialization of skilled help as opposed to help for general housework. Such conditions, therefore, have brought about, on the part of the management of the millions of homes in this country, a search for some alternate which will decrease rather than increase the operating expense. Home managers are now thinking how they can get along with less hired labor, or possibly dispose of it altogether. The use of motor-driven devices is one large factor in a logical solution of the problems encountered in the rendering of cheaper and better service in the home. No attempt is made here to consider the field of electric heating, which presents problems different, from an engineering point of view, from those of electric drive, but is of like benefit to the home management. Obviously, this progress in the elimination of labor is based upon availability of electric current in the home, which is an accomplished fact at the present time to an increasingly large extent. The following are the chief problems encountered in household engineering:—

1. A suitable supply of fresh water, both hot and cold

2—Heating of the house and outbuildings.

3—Lighting of the house and outbuildings.

4—Refrigerating and cooling, principally in connection with food and drink.

5—The disposal of waste material.

6—Ventilation.

7—Miscellaneous power requirements in the preparation of food, clothing, producing entertainment, etc.

"Wire Your Home" Campaign—An idea which promises fruitful results for everyone, from manufacturer to consumer

The "Society for Electrical Development" and kindred organizations in the United States have decided on a "wire your home time" campaign, extending from April 1 to May 15. Here is another idea for Canadian electrical interests—including the electrical contractor. Regarding the interest contractors should have in such a campaign the following article, by George E. Shepherd, E.E., in the National Electrical Contractor, is almost equally applicable to our own Dominion, and will interest our readers:

Should the Electrical Contractor Boost "Wire Your Home Time" Campaign?

At first glance this might seem a foolish question. Why should not the electrical contractor boost something which means more business? If he does not favor it and, in addition, refuses to lend his support, then surely he is not a progressive business man, and deserves nothing from the hands of the central station. This is the view commonly held, therefore, by the commercial manager or head of the ordinary lighting plant.

It may be interesting to note, therefore, that a good many contractors who are progressive and up-to-date business men, and therefore appreciate fully the possibilities and advantages to them in extending the use of electricity, are nevertheless not in favor of these special wiring campaigns. The writer of this article was quite a little surprised a few months ago during a correspondence which he had to learn that an organization prominent in boosting the extension and uses of electricity seemed wholly unaware of any such feeling on the part of the electrical contractor. It was their view that everyone should favor this, and that the reasons for it were self-evident.

As a matter of fact, if the matter of extending the use of electricity by the introduction of new construction followed the ordinary business routine, and were done under the regular conditions of profit and standards of workmanship, the sentiment would unquestionably be unanimous. It is because, however, the manner of conducting these campaigns is conducive neither to high standards of workmanship nor to legitimate profit that a great many leading electrical contractors are not interested in them.

In a majority of instances the campaign is not introduced with any real idea of giving the customer a high-grade class of work, nor with any serious concern as to whether or not the concern installing it make a satisfactory profit on the work. The sole idea back of it is the extension of the mains and service connections of the lighting company, with a consequent increased sale of current. In other words, an increase in revenue.

In line with this thought investigation shows that a great many of these campaigns are conducted and instituted by manufacturing concerns having a patented article or device to offer, such as an excess indicator, or something similar, and with this they go to the central station and offer their services—in many instances gratis—in the endeavor to secure wiring contracts, which, in turn, will require the use of their patented device. This is only one illustration and others [illegible]

Under such conditions the fundamental idea is to get contracts. Therefore, all sorts of expedients are resorted to, the commonest of course, being to see that the work is installed in the cheapest possible manner. This not only introduces, certainly in some instances, an increased fire risk, but almost invariably lowers the standards of electrical construction in the community, and, in addition, deprives the contractor of his legitimate profit.

Under such conditions it is not to be expected that good, sound business concerns would favor such a plan, much less go along with it.

In the writer's home city a campaign of this kind was instituted a short time ago, and it was found that the figures per outlet which were suggested by the canvassing company were about one-half the minimum figures which the members of the local electrical association agreed the work could be done for. A number of conferences were held, and the special committee went back to the association and had the members bring in data in the form of completed contracts taken from their books, and the whole proposition was gone over and figured out in detail. As a result, a slight concession was made, and the company finally closed with one of the association members, with the consent of the others, on the basis that he was to take all of this work at the price agreed upon. It is interesting to note, however, that this price was nearly 75 per cent. in excess of the prices at which this work was reported as being done in a number of other communities, and also that no other contractor-member of the association cared to take any of the work at the prices finally agreed upon.

It subsequently developed that the member who took all of this work was obliged to spend ten or twelve hours a day in looking after it; and, while he states he made a profit, he admits it was a small one.

The deeper significance of such conditions as above cited lies in the serious set-back which such campaigns may bring about in conditions in electrical construction which many progressive electrical contractors have worked years to bring about. In other words, in the serious lowering of standards which follow and in the danger of sacrificing safety and thoroughness to cheapness. This danger is further increased by the fact that, up to date at least, the narrower view has been taken that the prime consideration was to get the business, and not to add a given volume of new business in accordance with well-known standards. In a word, without special reference to the kind of work it might be necessary to install in order to bring about the desired result.

If this is a correct statement, then it is readily apparent that a great many reputable concerns will frown upon these campaigns. It is entirely possible, to be sure, to conduct campaigns of this sort in a perfectly legitimate way. That is to say, to extend and increase among the unwired houses of a community the business of the central station, and to install the work in accordance with accepted and well-known standards of good construction, and thereby gain the support and co-operation of the local electrical contractor.

Whether sufficient thought has been give to this, so that the solicitor for new business may go to the contractor with a plan which will merit his co-operation by reason of its recognition of the principles and standards of the other co-worker's business, is a question which it seems to me will have to be satisfactorily answered before any real progress may be made in these new business campaigns.

After all, the real aim of the central station is in entire harmony with the fundamental principles of the electrical contractor's business: Both seek to extend the uses of electricity and each with profit to himself. Unless both these conditions be brought about, there can be no real harmony of action nor co-operation, nor can there be any real hope of

Will You Be There?

The next get-together dinner of Toronto electrical contractors will be on Wednesday, Feb. 14, when the speaker will be Mr. Wills Maclachlan, inspector Electrical Employers' Association. Same place and time—Carls-Rite, 7.30.

A movement is on foot to hold an "Electrical Week" in Toronto and to institute an "Electrical Page" in the daily papers at stated intervals. Toronto electrical contractors are vitally interested in both of these suggestions, which may well form the basis of discussion at one of their Carls-Rite dinners. The ball is already moving; cannot the Toronto contractors get behind and so increase its momentum that we shall get it over the peak of "Obstacles Mountain"? Then about all we'll have to do is watch it roll down hill, and take in the profits.

a joining of forces, in the best sense, to bring about the conditions which such a campaign as the "wire your home time" seek to accomplish.

And so the whole matter would seem to come down to the old proposition of co-operation. There can be no real co-operation unless each brings to the other not only a full measure of good feeling, but a measure of equality and a recognition that the other fellow's strength, added to one's own, will accomplish a given result which neither alone can hope to accomplish and with consequent increased profit to both. Unless a man has something to offer which the other lacks he is not in a proper position to co-operate. He must first put his own house in order. This, it seems to me, should be the real thought back of any "wire your home time" proposition.

Special Notice to Western Men Interested in the Electrical Industry

A grand electric show will be held in the Exhibition Buildings, Vancouver, B.C., during the week of August 20 to 27, at which time also the annual convention of the British Columbia Association of Electrical Contractors and Dealers will be held.

Electrical men all over the Dominion are hereby invited to be present during this week. The electric show will be under the auspices of the British Columbia Association of Electrical Contractors and Dealers, and there is every indication that it will be a grand success. If you contemplate a trip to the coast this year arrange it for this week, when you will meet numbers of men in your business.

The following are giving this movement their hearty support: The Canadian General Electric Company, the Canadian Westinghouse Company, the Northern Electric Company, Messrs. Cope & Son, and Messrs. Horsman & Son, all of Vancouver City, whilst the British Columbia Electric Railway Company will have representatives on every committee and do everything possible to assure the success of the week.

Manufacturers who contemplate exhibiting should communicate at once with President C. H. E. Williams, North-West Trust Building, Vancouver, or Secretary E. Brettell, 781 Granville Street, Vancouver.

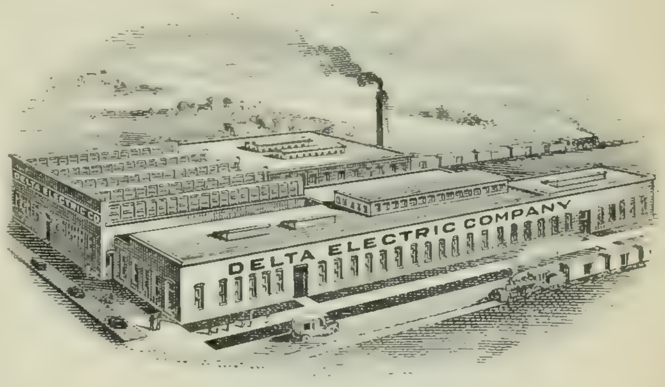
City Electrician Hutchison, of Victoria, following a test of nitrogen-filled lamps for street use, has reported that a more durable lamp is necessary if the best results are to be attained.

Progressive Manufacturers' Agents

One of the most progressive manufacturers' agents in Canada is that operating under the name of Houston & Co., with main office in Winnipeg and branch offices in other cities. The Toronto office was opened about a year ago, with Mr. A. J. Tallman, well known to the trade, in charge. This firm handles a complete line of electric lanterns, pocket flashlights, etc., manufactured by the Delta Electric Company, of Marion, Ind.

Though the business in electric hand lamps and flashlights has grown to immense proportions, it is possible that the convenience of these devices is not yet fully realized by the great majority of people. The growth of the business has been so uniform that, even though it has been rapid, it has frequently escaped the notice of those whose attention has not been definitely drawn to it. We can, perhaps, best understand the importance of the flash-light because if we could imagine it suddenly withdrawn from the market and could conceive of the immense gap that would be left in the electrical business of to-day.

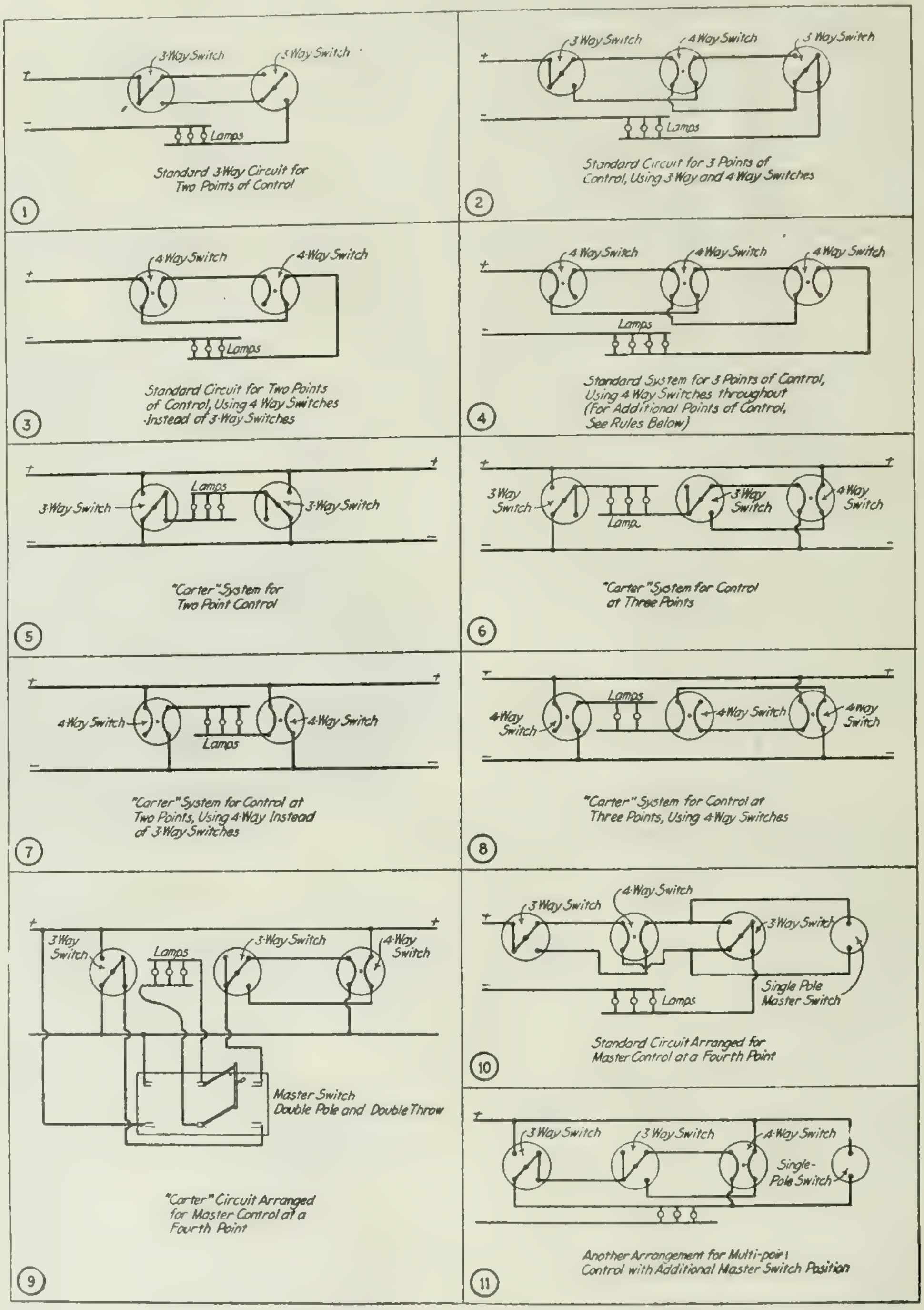
The Delta line has been designed to fulfill the highest use to which electric lanterns and flash-lights can be put—namely, the greatest usefulness associated with the lowest possible cost consistent with the highest quality of material. The accompanying illustration is a photograph of the factory of the Delta Company, where they make their lamps. It is understood that the products are made entirely from raw materials shipped direct from the mills, and, in turn, are manufactured complete through every stage until ready for use by the ultimate consumer. Houston & Co. carry a stock of these products at Toronto, Regina, and Winnipeg, and are in a position to give prompt service.



Nothing for Bond Holders

According to the report of Receiver Winter, of Riddel, Stead, Hodges & Winter, Toronto, it is doubtful if the bondholders of the Prince Rupert Hydro-Electric Company will receive anything on their investment. Total liabilities, exclusive of the bondholders' claims, amount to about $62,000, of which $23,500 is fully secured. A report has been turned in by the secretary, in which two courses are open to the bondholders. One plan would be to dispose of what machinery there is, which would realize approximately $75,000, pay off the creditors, and continue to hold the water rights, which would become of greater value in a few years. The question is whether to dispose of all assets at the present time and distribute the proceeds.

Conduits Company, Ltd., are distributing a very handsome 1917 calendar, illustrated by a reproduction of one of the best-known works of Eug. Berthelon—"The Forest of Fontainebleau." "Galvaduct" and "Loricated" stand out in prominent type, but appear quite at home in this "quality" company.



3-Way Switch
3-Way Switch
+
−
Lamps
4-Way Switch
Lamp
Master Switch Double Pole and Double Throw
Single Pole Master Switch
Single-Pole Switch

① Standard 3-Way Circuit for Two Points of Control

② Standard Circuit for 3 Points of Control, Using 3 Way and 4 Way Switches

③ Standard Circuit for Two Points of Control, Using 4 Way Switches Instead of 3-Way Switches

④ Standard System for 3 Points of Control, Using 4 Way Switches throughout (For Additional Points of Control, See Rules Below)

⑤ "Carter" System for Two Point Control

⑥ "Carter" System for Control at Three Points

⑦ "Carter" System for Control at Two Points, Using 4-Way Instead of 3-Way Switches

⑧ "Carter" System for Control at Three Points, Using 4-Way Switches

⑨ "Carter" Circuit Arranged for Master Control at a Fourth Point

⑩ Standard Circuit Arranged for Master Control at a Fourth Point

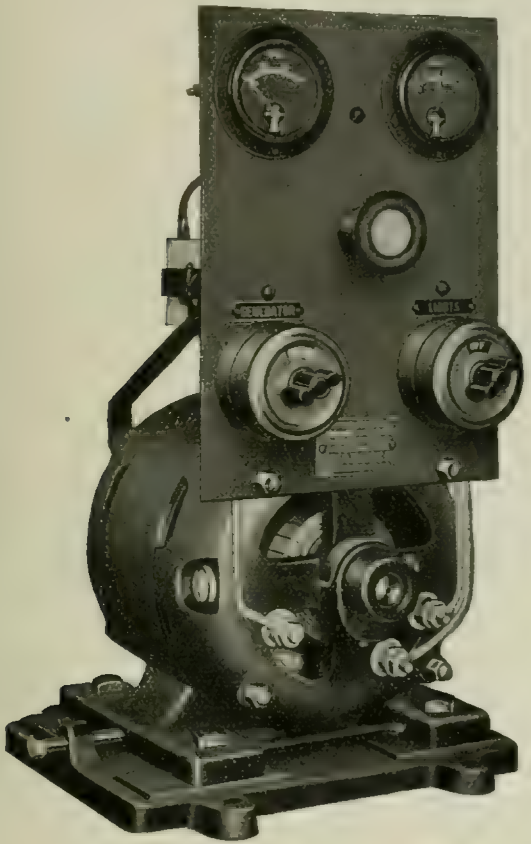
⑪ Another Arrangement for Multi-point Control with Additional Master Switch Position

Showing variety of wiring diagrams to meet the requirements of a control from two or more positions—Three-way, four-way and master switches.

What is New in Electrical Equipment

Small Isolated Plant

The S. D. generator, built by the Canadian General Electric Company, is intended for isolated plants with comparatively small demands for them. It is built to be belt-driven, and will furnish d.c. current for 175, 250, or 500 watts at 35 volts. It is shunt wound and complete with base, pulley, and field rheostat. The watt and ampere ratings are based on normal voltage of 35, but may be varied between 32 and 42 volts by means of the field rheostat. A steel panel, which is mounted on the generator but may be wall-mounted, carries the zero-centre ammeter for reading the charging and discharging current, voltmeter for reading generator voltage, two d.p.s.t. switches for operating charging and light circuits respectively, automatic cut-in and cut-out switch mounted on rear of the panel, and rheostat mounting, with necessary connections for adjusting generator voltage and charging current.

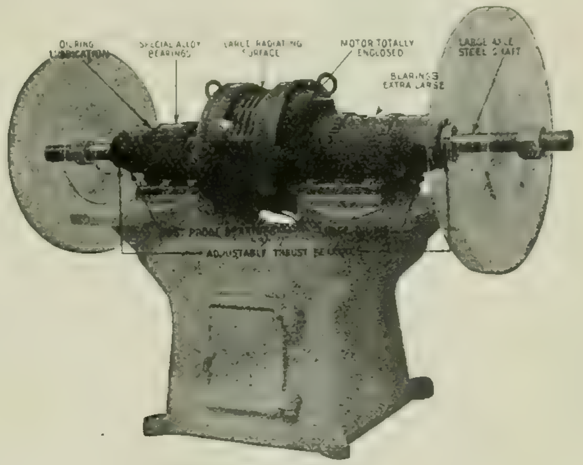


A New Low-Priced Fan

During the past year or two a distinct demand has developed for an electric fan at a low price for use principally in the home. To fill this demand the Westinghouse Electric and Manufacturing Company have included in their line of 1917 fans a type known as the "Westinghouse Whirlwind," which sells at a low price but, so far as sturdy construction goes, is the equal of the more expensive fans made by the company. The Whirlwind is an 8-inch fan, weighing about six pounds. Black steel blades are used, as well as a black steel guard, instead of brass. The speed control switch is omitted, so that the fan has one speed. It has a hinge joint so it can be mounted on a wall if desired, and also the patented felt base with which all Westinghouse fans are provided.

Alternating Current Grinder Motor

The grinder motor shown has been recently placed on the market by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa. It is designed for use on 2 and 3-phase, 60 cycle, alternating-current circuits and is constructed especially to meet the severe conditions to which such motors are subjected in grinding and polishing work. This grinder motor is obtainable in three sizes, having capacities of 5 h.p., 7½ h.p. and 10 h.p. respectively. The 7½ and 10 h.p. two-phase motors are supplied with auto starters. For the 5 h.p. 2 and 3-phase motors an ordinary knife switch is employed, and a special starting switch for the 7½ 2 and 3-phase motors. Pedestal bases, grinding wheels, and tool rests are furnished by the tool manufacturer. To protect all parts against wear and injury from grit and metallic dust, the bearings are made dustproof, and the motor is wholly enclosed. Large radiating surface is provided, however. The end brackets are solid and are cast integral with the feet, which are extra heavy and arranged so that they can be bolted rigidly to the pedestal. The heavy grinding wheels with which these motors are designed to be used, put a great strain on the shaft and bearings. These parts are therefore made extremely strong and rugged. The shaft, which is made of axle steel, is of extra large diameter, and is extended at both ends to receive the grinding wheels. The bearings, which are the only wearing parts on the whole motor, have very large bearing surfaces, insuring long life. Each is thoroughly lubricated by two oil rings. The end thrust is taken up by adjustable collars. The rotor of the motor, which is of the squirrel cage form, cannot be damaged. There are no moving contacts. The rotor bars are firmly fastened in the iron core and are short circuited by end rings. No bolts or screws are used, and there is nothing about the rotor that can work loose even under the most severe service, or that will deteriorate under heat. The stator winding is thoroughly treated with an oil and moisture-resisting varnish. In motors larger than 5 h.p. the winding consists of coils wound on forms and completely insulated, then laid in the open stator slots and securely held in place by means of wedges.



The Eugene F. Phillips Electrical Works, Limited, Montreal, have obtained from the Toronto Hydro-Electric Commission a contract for 12 miles of 250,000 c.m. paper insulated lead covered cable, for a working pressure of 13,200 volts.

Wiremold—The New Surface Moulding

We have just been shown a sample of something quite new to Canada in the way of metal moulding for surface wiring. It is known as "Wiremold," and is used like conduit. Though manufactured in two sections, it is assembled at the factory before shipment, and goes up in one piece. Figs. 1, 2, and 3 tell the whole story. To put the moulding up just fasten the first length of coupling to the wall or with a No. 8 flat head screw, as in Fig. 1; then start the grooves in the next length over the edges of the coupling, as in Fig. 2, and close up, as in Fig. 3. Whether a corner is turned, a switch cut in, or a T or four-way junction made, the method is on this same simple principle. This moulding is made in a two-wire size, just big enough for the easy fishing of a pair of 14's or 12's. The junctions provide room for a good "fat" splice. No tools are required, except only a fine-tooth hacksaw. Brass bushings are provided for all outlets, to give a smooth finish to the moulding. A complete line of elbows, tees, switch outlets, etc., are included in the line. The outlets are made to receive any standard switch, socket, etc. The moulding is made in 10-foot lengths (the height of the average ceiling in old buildings), done up in corrugated cardboard packages of 100 feet to the package; in the box with every fitting is a printed slip, telling just what that particular fitting is for and how to use it. This new moulding promises to be very popular because of its great simplicity, utility, and adaptability to all standard wiring devices. Even its color has been made to harmonize with the standard wall coverings of the leading offices and stores, and where painting is necessary the buff enamel serves as an excellent primary coat. Conduits Company, Ltd., makers of the famous "Galvaduct" and "Loricated" conduits, are sole Canadian agents for "Wiremold." This company is now distributing descriptive catalogues. If you haven't received your copy a request will bring one promptly.

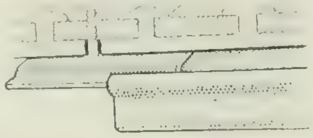


Fig. 1.

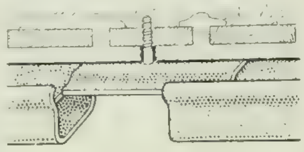


Fig. 2

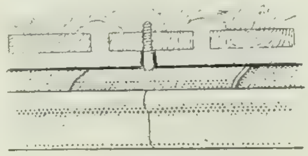


Fig. 3.

Taking "Thrift Campaign" to Heart

Apropos of the necessity for more strict enforcement of the liberal children's fares by the company we publish an account of an incident related to us:

"I was waiting," says a correspondent, "to board a Davie car at Twenty-fifth Avenue, one general holiday, when there was a big crowd of passengers all waiting to get down to English Bay. As the people were entering the car I noticed two women with quite a number of youngsters to push their way into the car with the crowd. As the last youngster got inside without paying a nickel for any of them—the women walked away to a jitney at the corner of Twenty-fifth and Main and rode down town, calm in the knowledge that the B. C. Electric would deliver their children safe and sound at English Bay free of charge."—B.C.E.R. "Buzzer."

Obituary

Sergeant H. S. MacLean, of Victoria, B.C., was killed in action in France on January 17. He was the youngest brother of Mr. John S. MacLean, of the Canadian General Electric Company, and a son of the late Alex. MacLean, of Ottawa, formerly Canadian Trade Commissioner to Japan.

Patrick Talbot Bowler, city electrician of New Westminster for almost a quarter of a century and an electrical engineer of wide reputation, died on Jan. 6th, following an operation. He had been in failing health for several years, and resigned his duties early in 1916. Born in Ireland 62 years ago, the late Mr. Bowler came to the Pacific Coast 26 years ago to install an electric light system in Victoria for the Royal Electric Company, of Montreal, by whom he was then employed as an electrical engineer. Later he installed a street system in Vancouver, following which he was engaged by New Westminster Council to put in the first arc lamp street system and incandescent house system, power being furnished by a local planing mill. The year following he installed a power plant for the city and assumed charge of the department. A few years ago he initiated the change to the present nitrogen lamp system, leaving the work to be carried out by his successor, J. C. Digby, who had served under him for over 23 years.

Personal

Mr. G. Gordon Gale, formerly general manager and chief engineer, Hull Electric Company, has been appointed vice-president and general manager.

Mr. R. H. Sperling, formerly general manager of the British Columbia Electric Railway Company, has been granted a commission in the British army.

Mr. D. M. Mawhinney, formerly with the Winnipeg, Selkirk, and Lake Winnipeg Railway, has been appointed engineer for Rockwood Municipality, Man., with office at Stonewall.

Mr. F. J. Cockburn has retired from the commission appointed by the Quebec Government to enquire into the question of a new franchise for the Montreal Tramways Company. He is succeeded by Mr. A. W. Stevenson.

Trade Publications

Fans—two leaflets issued by the Robbins & Myers Company, illustrating and describing their lines of desk, oscillating, and ceiling fans.

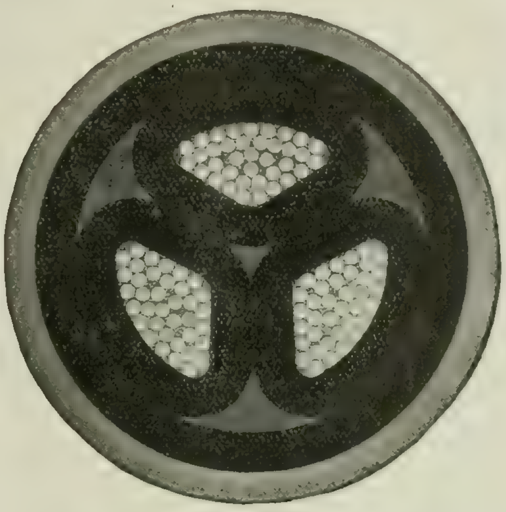
Condulets—folder issued by the Crouse-Hinds Company of Canada, Ltd., Toronto, illustrating and describing "Safety First" hand lamps, condulets, and reflectors.

Engineering Data—booklet issued by the Metropolitan Engineering Company, entitled "Data for Central Station Engineers," and containing a quantity of instructive matter on Metropolitan protection equipment. The booklet contains a mass of useful information of the type daily referred to by operating engineers and electrical contractors; well illustrated throughout.

C. G. E. Publications—bulletin No. 46103-A, describing Type M demand meters; bulletin No. 46104-A, describing Type G demand meters; bulletin No. 46101-A, describing Type P demand meters (printometers); bulletin No. 47476, illustrating and describing Type F, Form K22, oil circuit breakers; bulletin No. 47475, re Type F, Form K26, oil circuit breakers; bulletin No. 47474, Type F, Form K21, oil circuit breakers; bulletin No. 26291-A, portable test meters—types IB-5 and IB-6 for alternating current circuits.

Toronto Hydro Electric

orders another eight miles of



PHILLIPS CABLE

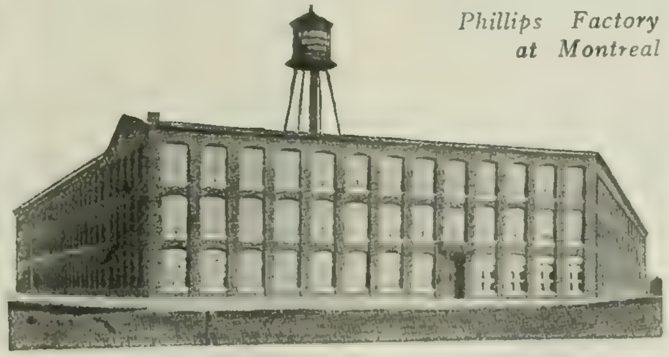
Here is strong endorsement of the quality and serviceability of Phillips heavy duty cable. The Toronto Hydro Electric System recently sent us a repeat order for the supply and installation of 8 miles of 250,000 C.M., 3-core, 13,200 v. cable, illustrated above. After installing miles of our product and giving it a most thorough testing in actual use, this re-order is conclusive evidence of the opinion of "T.H.E." experts. Phillips Cable will give you the best of service for power, telephone, lighting, railway or special use.

Write us for further details.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

Current News and Notes

Bathurst, N.B.

The Town Council of Bathurst, N.B., have under consideration the purchase of the privately-owned electric lighting plant. The owners have agreed to sell for $116,686

Courtney, B.C.

The citizens of Courtney, Vancouver Island, who had been paying 8c per kilowatt hour for street lighting and 11c for house and store lighting to the Cumberland Electric Light Company, have carried a by-law authorizing the purchase of the poles and equipment put in by the company. A contract for power has been entered into with the Canadian Collieries Company at 2½c per kilowatt hour, so that the former charges can be cut in two and still leave a profit for necessary improvements.

East Angus, Que.

The Brompton Pulp and Paper Company, East Angus, P.Q., have decided to develop another hydro-electric power three miles below their pulp and paper plant at East Angus, on the St. Francis River, giving an additional 6,000 h.p., and plans are now being prepared. The company have three powers. One has a head of 28 ft., a minimum development of 4,000 h.p., and a maximum of 6,000 h.p.; a second with a head of 22 ft. and a maximum of 4,000 h.p.; and a third, at Brompton, with a head of 38 ft. and a minimum and maximum respectively of 6,000 and 10,000 h.p.

Halifax, N.S.

Arrangements for the financing of the Nova Scotia Tramways & Power Company, who have taken over the Halifax Electric Tramway Company, have now been completed. The authorized capital of the company is $15,000,000, of which the initial issue will be $6,250,000 in bonds and common and preferred stock. The bonds are being offered at 95½ and bear five per cent.; the preferred stock is quoted at par and carries a bonus of three shares of common stock for each ten of preferred.

Montreal, Que.

Armstrong, Whitworth of Canada, Limited, are installing three electric furnaces, of a total capacity of 4,000 kw., at their works at Longueuil, P.Q., and the Thomas Davidson Manufacturing Company, Limited, Montreal, will instal four furnaces, each of 1,000 kw., in a new plant now being erected in Montreal.

Mr. W. G. H. Cam, Montreal, is preparing plans for a street and house lighting scheme for Greenfield Park, P.Q. The former will be series lighting, the nitrogen-filled lamps being carried on wooden poles. The area to be served is about nine miles.

Pembroke, Ont.

The Pembroke Electric Light Company, Limited, will instal an additional unit on the Black River. A contract has been let to the Boving Hydraulic and Engineering Company, Lindsay, Ont., for an 1,800 h.p. single-runner horizontal 514 r.p.m. turbine. The electrical equipment, to be supplied by the Canadian Westinghouse Company, will consist of a 2,500 volt, 3-phase, 60-cycle generator, direct connected to the turbine; three transformers, each of 750 kw., and switchboard. Mr. [illegible], Montreal, is the consulting engineer.

Peterboro, Ont.

The City Council of Peterboro, Ont., conferred with Sir Adam Beck regarding the purchase by the city of the street railway at Peterboro and the Otonabee electric plant, which have been operated by the Hydro-Electric Commission of Ontario for the past eight months. Information to date is that the Otonabee plant will be purchased for $7,512, but the railway matter will be left in abeyance until money conditions become improved.

Fire in the oil tanks in the transformer test department of the C. G. E. plant at Peterboro on February 2 resulted in a loss estimated in the vicinity of $50,000.

Toronto, Ont.

In view of the government requiring the three power companies at Niagara Falls, Ont., to be prepared to supply the Ontario Hydro-Electric Commission with 50,000 additional horse power by April 1 next, a request will be made by the power companies for the use, until the Hydro-Electric Commission's proposed plant at Queenston is ready, three years hence, of a portion of the 6,600 second feet which remains unused of the quantity allotted to Canada by international treaty.

Vancouver, B.C.

Experiments are now being carried out in the British Columbia Electric Railway shops at Vancouver with a view to fitting the company's interurban cars with a new style of heater, the type now in use being most unsatisfactory to the travelling public. It is located under alternate seats, while the new style which it is proposed to adopt will probably be placed beneath the floor, the heat passing up through gratings.

Winnipeg, Man.

A proposition by the British North American Hydro-Electric Power Company to establish a plant for power distribution throughout the Province of Manitoba has been placed before the government. The company requires a guarantee of bonds to the extent of $2,500,000 for a term of thirty years. Surveys were made by this company last summer, and the government will consider the matter further.

Mr. Geo. L. Hatheway, formerly with Messrs. Pass & Seymour, of Solvay, N. Y., is now located at 120 Liberty Street, New York City. He is representing the Steel City Electric Company, Killark Electric Manufacturing Company, National Electric Porcelain Company, Capital Porcelain Manufacturing Company, and Eastern Flexible Conduit Company.

An attractive window display—Toronto "Hydro."

Electrical News
Generation, Transmission and Application of Electricity

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Coal Shortage the Central Station's Opportunity

A question to which there have always been two sides, because the conditions surrounding it are so various and variable, is the supply of electric current for lighting and small power requirements to industrial plants. It has been claimed for the isolated electric plant that much of the equipment is needed, in any case, for heating. Often the product of the factory is such that steam is required the whole year round. With very little added capital expenditure, therefore, and no added overhead whatever, it is claimed, electricity can be produced at the same time. It is also said that because of frequent failures on the larger plant system the isolated plant gives a better guarantee of continuous service.

Against this, it is, of course, argued that the actual cost of operation of an isolated plant is very rarely determined with accuracy and that the real cost per unit is much greater than the owner has any idea of. In addition, if the electric plant is operated and maintained efficiently it requires the services of a more highly paid employee. And regarding continuity it can now be said that the average central station in large cities is giving a service which is approaching perfection. A further argument in favor of central station service, and it is a very strong one, is the engineering inspection service which is included, the technical advice regarding changes and extensions and the prompt assistance in case of damage to the equipment, which will inevitably occur sometimes in even the best regulated factories.

These are merely suggestions of the arguments that are advanced on both sides of the question, but the point that appeals to us particularly at the moment is that if the advantages and disadvantages were evenly balanced with coal at normal prices, (we admit it merely for the sake of argument), has not the big increase in the price of coal thrown the balance of power into the scale on the side of central station supply? The cost of coal is a very considerable item in the final cost of current generated by the isolated plant, but is much less important in the cost of central station supply, where the investment is distributed over a wider range of equipment. For this reason the increased cost of fuel is immediately felt by the isolated plant, whereas the central stations, though affected, have not, in general, found it necessary to increase their rates; hydro-electric plants are, of course, entirely independent of the coal situation.

This, therefore, would seem to be a very opportune time for the central station manager to make a careful inventory of the isolated plants in his district and to place the facts fairly and squarely before these factory owners. Not only are the arguments that may be advanced most convincing at the moment, but it will doubtless be found that isolated plant owners are more ready than formerly to rid themselves of this unnecessary adjunct of their business, which has caused them so much worry and inconvenience.

Organization for War or Peace

The value of industrial research, recognized for so many years in Europe, and especially in Germany, which is, indeed, probably the basic reason for Germany's rapid commercial development, her unprecedented preparedness for war and the wonderful manner in which she is standing the strain of that war, though shut off from her usual avenues of trade, is at last being recognized on this continent, both in Canada and the United States. Primarily, of course, this is a "peace" proposition calculated to encourage and increase and hasten the development of natural resources and home industries, and, therefore, Canada is too late with her organization to be of as much help in winning the war as if she had awakened to the demands of the situation ten years ago. That is no reason, however, why we should not make as rapid progress as possible now we are started, for we need our best organization to win the war, and we shall need it almost as much to gain and maintain a place among the commercial nations of the world when the race begins immediately following the war.

The work being outlined by such bodies as the Research Advisory Council (recently appointed by the Dominion Government) and the Joint Committee of Technical Organizations, (including all engineers and technical men) is of very first importance to the country and is being carefully followed by the general public. These two organizations, though formed ostensibly for similar purposes, differ, however, in that the Joint Committee is concerning itself more particularly at the moment with the solution of strictly war problems. The Ontario branch of this Committee has subcommittees actively engaged on various phases of war work —inventions, locating technical men for special work, returned soldier relief and training, and so on, and already this work is bearing fruit.

On the other hand, the Advisory Council is concerning itself chiefly, as yet, with the gathering of information, and is moving toward the establishment of a number of industrial research laboratories at strategic points in Canada.

These two organizations it may also be added, are working together, each aiding the other where there is any sign of overlapping.

The moral behind all this is, as we see it, that every engineer or technically trained man, and every man interested directly in the commercial and industrial development of this Canada of ours is personally responsible for seeing that these organizations are supplied with all information and assistance as promptly as may be. This applies to the questionaires being sent out by the Advisory Council. It also applies to the census cards being mailed to Ontario members by the Joint Committee. Fill in the information promptly and send it back. If you are not on the list and ought to be, make the fact known. It's all for the common good—give your assistance promptly.

The Electric Vehicle is Coming

The day of the electric vehicle is surely not far distant. A new model of an electric passenger vehicle in a recent run from New York City to New Haven, Conn., made a highly commendable record. There were three passengers carried, and the distance of 88.2 miles from Columbus Circle, New York City, to the Hotel Taft, New Haven, Conn., over an extremely hilly, although smoothly constructed road, was accomplished in 3 hours and 45 minutes, including all stops, traffic delays and reduction of speed through thickly populated centers, and on a single charge of the battery. While an average speed of 23.4 miles per hour over a distance of 88.2 miles may not arouse the interest of the speed fiend, yet when it is remembered that this speed is maintained over average roads, the speed is about as good as can be maintained by either a gasoline or electric car with comfort to the riders, and with safety to pedestrians.

This new model is furnished with a control system which provides for the safety of the driver and other occupants. It consists of an automatic device which, by the pressure of the foot on a pedal, even though the car is travelling at full speed, instantly cuts off the current and applies both brakes, regardless of the position of the control lever. It is impossible to start the car again until the control lever has been returned to neutral position.

This run is an evidence of the "electric's" ability to make an average long run, covering the ground at a comfortable speed, with the fears of possible breakdown practically eliminated. A series of runs have recently demonstrated the fact that an electric automobile can be very satisfactorily used for interurban travel. These runs averaged distances of about ninety miles per trip, and were conducted with absolutely no trouble of any sort. One of the longer runs was from Chicago to Milwaukee, a distance of 101 miles.

The Engineer and the Crisis

The hour has struck and the nation wakes to face at least the possibility of entering the tremendous struggle which is rending civilization with ferocity unparalleled even in the Dark Ages. Hostilities do not necessarily follow a breach in diplomatic relations, but a breach arising from two years of intolerable exasperation is not easily healed. And nothing save a sincere and complete reversion of purpose, which must be regarded as rather improbable, can avert actual warfare. If it comes, the engineer must rise to the occasion with an alertness and vigilance unequaled in military history. The situation is a singular one. The United States is safe from the major operations of a hostile navy, because that navy is hopelessly bottled up by superior force, and our own navy is almost equally powerless for aggression. Neither the United States nor Germany can make use of an invading army so that the probable hostilities are practically limited to those between marauding submarines and the defensive fleet on the water or in the air. The war, if it comes, will be a war of wits, of ingenuity and resourcefulness.—Electrical World.

Electric Drive in Milling Industry

As indicating the importance attached to electric drive in the milling industry the following extracts from a letter just received at this office from a prominent Ontario milling company, are of particular interest. The letter is in reply to an enquiry regarding a report that additions were being made to the electrical installation in this particular plant. The unsolicited testimonial of the value of electricity in this industry has a particular bearing on the question of whether isolated electric generating plants are a paying proposition. While this may have been an open question in the past, the high price of coal, and in some cases the shortage, has apparently thrown the balance in favor of electricity supplied by the central station:

"Answering your letter of February 14 re electric installation, we wish to advise that we have a 30 h.p. electric motor which we have been using in our wheat-cleaning department for the past two years and have now on order two extra motors; one is 30 h.p. and the other is 200 h.p. The smaller one we were fortunate in being able to secure for immediate installation, but the larger one we are unfortunately compelled to wait four months for delivery.

"We are now very sorry that we did not make provision for installation of these motors at an earlier period, but did not consider it profitable to make the installation in the past owing to our steam plant being a very economical one while we were able to get coal at 75 to 90 cents per ton at the mines.

"With the extreme advance in coal values plus the extra duty and war tax, **it is absolutely impossible for us to run our business profitably, except by the installation of electricity.** Were we able to secure coal sufficient to meet our requirements until next July we possibly would have been able to delay purchasing the above machines."

The Electric Club of Toronto

The Electric Club of Toronto has been favored during the month of February with a well sustained attendance and most interesting addresses and entertainment. On February 2 Professor J. C. McLennan, Director of the Physical Laboratory of the University of Toronto, and a member of the newly appointed Research Advisory Council, addressed the members on the aims of the Council and the need for industrial research so that the work of developing our national resources and our industries may be carried along with greater efficiency and dispatch. Dr. Horace L. Brittain, general manager of the Civic Industrial Bureau, February 9, described the intricacies involved in the making of a city budget. On February 23 the entertainment took the form of a visit to the Adelaide Street Exchange of the Bell Telephone Company, when Mr. Dunstan and his staff gave unlimited time and patience to the many inquiries of the members. At the final meeting of the month, February 23, W. K. McNaught, C.M.G., member of the Hydro-electric Power Commission of Ontario, spoke on "The Future of Ontario from the Standpoint of Power Development."

For March the following program has been arranged

March 2—Mr Benjamin A. Gould.
March 9—Mr E. P. Heaton, Provincial Fire Marshal.
March 16—Sir Frederick Stupart.
March 23—Mr. L. A. Dunington Grubb, Garden Architect.
March 30—Mr. L. B. Beale, B. C. Lumber Commissioner for Eastern Canada.

Montreal Electrical Luncheon

The attendance at the Montreal electrical luncheons keeps up exceedingly well. On February 7, Mr. W. R. Allen, of Watson, Jack and Company, Limited, spoke on the question of dyes, especially in relation to the German industry and the progress made in England since the beginning of the war. Mr. Allen traced the history of coal tar dyes from their discovery by an Englishman to the immense development of the industry in Germany. That country had, with great foresight, employed a very large number of chemists investigating and patenting new processes, so that at the outbreak of war Germany made eighty per cent. of the world's production of coal tar dyes and Britiain made five per cent. When war came, Britain found that plants worth $1,000,000,000 were dependent on a supply of coal tar dyes. Arrangements were made so that the raw material could be shipped from Britain to Switzerland and the refined product was shipped back. This tided over things for a year. The British Government then backed dye enterprises, with the result that dyes of a very fine range and quality were being turned out, and in Mr. Allen's opinion Germany would never hold the same position in the industry as she did prior to the war.

On February 14 the talk was still along war lines, although from a very different angle. Mr. G. G. McDonald, of the Canadian General Electric, who was among the earliest to enlist, told of his experiences at the front. Mr. McDonald was for ten months in the front line trenches, was buried three times in shell craters, went through several gas attacks, and finally was sent to an English hospital owing to a twisted leg. He hopes to again get back on active service. The talk was a plain narrative of how things are run at the front, and was explanatory of the routine of the ordinary soldier. He told of the dangers of stringing barbed wires, how the food and mails are transported, how raids are carried out, and how preparations are made for a big attack or "show," as it is called in the trenches. Notwithstanding the great hardships which are inevitable, Mr. McDonald said, the men were very cheerful. The hospital arrangements were stated to be marvels of organization, and from everyone connected with the hospital they received the best treatment possible. A collection for the Patriotic Fund totalled $80.

Shawinigan's Annual Report

The annual report of the Shawinigan Water and Power Company is just to hand and denotes the wonderful development that is taking place in the district adjacent to this company's plant, as a result of an aggressive business policy backed by an ample supply of electric energy.

During the past year the St. Maurice Construction Company, Limited, a subsidiary of the Shawinigan Water and Power Company, has continued the construction work on the La Loutre Storage Dam and steady progress is reported. This work has entailed the building of twenty miles of railway, the organization of a river transportation system, and the construction of cofferdams in the east channel of the river. The concrete has now been placed in the east channel and work is proceeding on the west, or main, channel. This work is up to schedule and should be completed by the end of the present year.

The North Shore Power Company, another subsidiary, has extended its field of operation so as to include the principal manufacturing towns between Three Rivers and Quebec.

The Three Rivers Traction Company, having obtained a franchise from the municipality of Cap-de-la-Madeleine, built three and one-half miles of new track connecting the town with Three Rivers.

The Public Service Corporation of Quebec, which is supplied with power for Shawinigan, has been placed on a sound footing, both as regards organization and physical condition. Steady progress is being made in the extension of the corporation within the limits of Quebec.

A contract has been made with the Southern Canada Power Company providing for delivery of power in the section south of the St. Lawrence River not included in the territory served by the Continental Heat & Light Company, another subsidiary of the Shawinigan Water and Power Company. A transmission line has been constructed from Windsor Mills to Sherbrooke, which was placed in operation in January of the present year. This means that the Shawinigan Water and Power Company is now delivering power to all of the larger cities and towns in the province of Quebec.

The Canada Carbide Company, Limited, which makes calcium carbide by an electric reduction process, have enjoyed an active demand for their product, and as a result of recent extensions it is anticipated that the output for 1917 will largely exceed that of any period in their history.

The Canadian Electrode Company, Limited, which was organized to meet the demand for electrodes used in the various electrical industries at Shawinigan Falls, has completed its plant and is now in a position to supply its product.

The Canadian Electro Products Company, another subsidiary of the Shawinigan Water and Power Company, have completed the construction of an extensive plant at Shawinigan Falls for the manufacture of certain chemical products required for war purposes. This plant is now in operation and it is anticipated that its activities in the production of chemicals will continue after the war demand ceases.

The construction work of the Laurentide Power Company is completed, and the plant at Grand'Mere has been put in full operation. The Shawinigan Company is operating the power house by arrangement. Power is now being taken by the Shawinigan Company from the Laurentide Power Company beyond the amount covered in the original contract.

The total amount of power used at Shawinigan Falls is nearly 100,000 h.p. This amount will be increased with the operation of new industries, and the city may well claim to be one of the great power-using centers in the world.

The report states that during the past year, the St. Maurice district, including the cities of Grand'Mere, Shawinigan Falls, and Three Rivers, has seen a remarkable growth.

The Shawinigan Water and Power Company, the report states, has contributed liberally to the Canadian Patriotic Fund and other worthy relief funds. They have also maintained the payment of wages to employees who are on active service.

The following are the officers of the company:—J. E. Aldred, president; Howard Murray and Julian C. Smith, vice-presidents; Thomas McDougall, chairman of the board; W. S. Hart, treasurer; James Wilson, secretary. The Board of Directors is as follows:—Thomas McDougall, chairman, Montreal; R. M. Aitken, London; J. E. Aldred, Montreal; W. S. Hart, Montreal; Sir Herbert S. Holt, Montreal; R. W. Kelley, New York; Sir M. Mitchell-Thomson, Bart., Edinburgh; Denis Murphy, Ottawa; Howard Murray, Montreal; Julian C. Smith, Montreal; and E. R. Wood, Toronto.

Mr. J. L. Englehart, chairman of the T. & N. O. Railway Commission, in an address before the Empire Club, Toronto, stated that preparations are being made to electrify their line. During the past two years the line has been completely re-surveyed.

The town council of Newmarket, Ont., have reduced the present meter rate of 4 cents per kw. to 3 cents.

Hydro-electric Development in Alberta

Possibilities of a Provincial System Outlined—Required Capital Less Than Twelve Millions—Many Growing Industries Demanding Electric Power

By Mr. A. J. Cantin

The Province of Alberta, with its 225,285 square miles, and a population of over 550,000, has no large manufactures of any kind. These conditions, however, are being remedied, and it will not be many years before large industries will be doing a prosperous business in this province.

Geographic Situation

The Alberta geographic situation is excellent with regard to industrial development. To-day, west of Fort William, there are very few industries of great importance, the west relying on eastern manufacturers for its requirements. Outside of the coarser food stuff, such as beef, pork, and flour, we import over eighty per cent. of the food consumed in the three prairie provinces. This is also true of boots, shoes, clothing, harness, farm implements, and machinery of all kinds. There is no good reason why this condition should exist, but it is with us, and it is up to us to rectify it at the earliest possible opportunity. The day is here when the home market furnishes strong incentive to enterprising citizens to develop Western Canada industrially.

Industrial Map of Canada

If we look at an industrial map of Canada we find the manufacturing for the whole of the country is done between Quebec city and Windsor, Ontario. In fact, for the year 1916 the manufacturers of Ontario turned out 45 per cent. of the total production of the country. Of course, there are important industries outside of this area, but there are perhaps more than 75 per cent. of the industries of Canada in this territory. Several things have contributed to these conditions; perhaps the most important one is the St. Lawrence River, and the Great Lakes.

Early Days of the Colonies

In the early days of the colonies the rivers and lakes offered good opportunities for travelling and trading. When the country began to develop the people still remained close to the waterways. The requirements of the early settlers were few, and they produced nearly everything at home. With the advent of the railway the trade took a new lease on life, and began to expand rapidly. The various rivers were used to operate manufactures, but it was not until electricity took its place as the foremost motive power that the provinces of Quebec and Ontario began to expand industrially.

Hydro Electric Systems in Canada

To-day we find that nearly all large industrial centers in Canada are within the net of extensive hydro-electric systems. We find Niagara Falls the heart of the Ontario Hydro-electric System, which has proven a success, expanding at a rate beyond the wildest imagination of its promoters.

Around Montreal the conditions are similar. Instead of having government ownership, all the hydro-electric systems are privately owned. Nevertheless, it is the heart of several large systems furnishing cheap power to innumerable industries.

Industries Close to Rivers and Coal Fields

Not only in Canada are industries located close to rivers, or within the net of hydro-electric systems, and coal centers. An industrial map of the United States shows that the New England States, with their numerous rivers, and being close to the sea shore, have, for a given area, more industries than any other part of the country. One of the big industries is the manufacture of cotton, and this district was, for a number of years, the greatest center of this industry. This is fast changing since the large hydro-electric systems have been constructed in the Virginias and the Carolinas, and the bulk of new mill construction has been in those states.

New Industrial Center

A new industrial center rapidly coming to the front is that around Keokuk, Iowa, which has the largest power plant in the United States, that of the Mississippi River Power Company. Industries of all kinds are being attracted to this center, and in the course of the next few years will likely be the greatest industrial center of the United States.

Transportation

Alberta is at a disadvantage relative to its transportation, in that it has no navigable waterways connecting with the sea; otherwise all advantages desirable are to be found here. We have three transcontinental railways, and a large number of important rivers, coal, lumber, clay, tar, sand, natural gas, and other raw materials in unlimited quantity.

This province will undoubtedly some day be the manufacturing center for the vast fertile region west of the Great Lakes. Our waterways will some day yield millions of horse power. It is only a few years since capitalists have begun to look into the power possibilities of our rivers, owing to the limited demand for power and the small population of this province.

Hydro-electric Systems in Alberta

At Calgary there are two hydro-electric power companies, with an aggregate of 32,000 horse power generating capacity. The Edmonton Power Company has started on a 55,000 horse power development on the North Saskatchewan River, seventy miles southwest of Edmonton, and there is talk of smaller developments in the province, but none of these enterprises have any province-wide program.

An analysis of the annual report for the year 1915, showing the cost of generating electric power in Edmonton and Calgary, and the various towns and villages along the various proposed main lines in Alberta shows that the cost of power to the various municipalities, not including fixed charges, amounts to $1,937,950.

O. H. E. P. Commission Earnings

If we take the earnings of the Ontario Hydro-electric Power Commission as a basis for comparison, we find that they are 17 per cent. of the capitalization. This gives them a surplus of 4 per cent. after paying operation, maintenance, depreciation, and fixed charges.

Capitalization for Alberta

On this basis we find that a capital expenditure of $11,239,000 could be made with reasonable assurance of financial success, as the cost of construction is not more here than in the east. It must be remembered that these are the returns for the year 1914, the return six years hence, say 1923, should be greatly in excess of this amount.

South Eastern Terminal

Commencing in the south of the province, Medicine Hat, which is on the bank of the South Saskatchewan, would be the southeastern terminal of the system. At this point a power plant of 40,000 horse power could be erected. Coming northwest to Calgary, we find the Bow River and its tributaries, with proper regulation, could be harnessed to 45,000 h.p. All this power is within fifty miles of the city. At this writing the power is developed to the extent of 32,000 h.p At Red Deer, on the Red Deer River, a plant of 10,000 h.p. could be erected at a reasonable cost.

Power Possibilities North of Edmonton

The power possibilities north of Edmonton seem to be unlimited. Commencing at Grand Rapids on the Athabaska River, with a dam 150 feet high, water could be backed for a distance of 45 miles, and by dredging a few hundred feet a head of 212 feet could be obtained, giving a capacity to this plant of 250,000 h.p. the year round. From Grand Rapids to Fort McMurray, a distance of 80 miles, there is a drop of 410 feet. If the total head could be developed the Athabaska, from the Pelican Rapids to Fort McMurray, would give us a total of 900,000 h.p. In all instances the river bed offers good foundation for high structures. The river bottom is a good quality of sand and limestone. It might not be possible to develop the total available head on account of cost and engineering difficulties.

The Peace River

The Peace River, at the Rocky Mountain Canyon, could easily develop 150,000 h.p. At Vermilion Falls, another 100,000 h.p. could be developed. This is the capacity with one generating plant at each of these various power sites. However, the cost in some instances would be great, and it will be many years before these northern sites could be made remunerative.

The Slave River

Perhaps the best power site in this province is on the Slave River, near Fort Chipewyan. It is reported by engineers and prospectors that at least 1,000,000 h.p. could be developed there. This, however, is so far north that it is out of the question. There are a number of good mineral strikes reported in that far country, also an Indian legend of an enormous lost copper mountain in that district, and it is actually found in large quantities along the Mackenzie River. The Eskimos are using it in its native form to make a few crude tools used by this primitive people.

New Railway to the Far North

At the next session of the Dominion Parliament, application will be made for a grant under the usual terms by interested parties to build a railroad from Sawridge to Fort Smith, a distance of nearly 900 miles north of Edmonton. This railroad should facilitate the prospecting of this vast country, and also help the development of these large mineral deposits which have so far been located.

Estimated Cost Per Horse Power

The estimated cost of the Edmonton Power Company for their complete system is approximately $90 per horse power; the Calgary Power Company, with an authorized capital of $3,000,000, of which $1,800,000 is paid up, have a generating capacity of 31,000 h.p., making a capitalization around the $90 per horse power.

Power Now in Use

The present amount of power developed in Edmonton and Calgary is 67,000 h.p., with approximately 33,000 h.p. developed by municipalities and private companies which would be covered by the proposed hydro electric transmission system of about 700 miles of distribution lines.

This amount of power, costing $100 per horse power, would represent an expenditure of $10,000,000, not including the local distribution systems. The various lines of the system would cover the oldest settled and the best parts of Alberta. The building of a system such as here described would open untold opportunities in the industrial and electro-chemical industries. We have an unlimited amount of coal, lignite, bituminous, and anthracite, so that the dye industry could be developed here in Alberta on a larger scale than it exists at present in any part of the world.

Coal in Alberta

Speaking of our coal resources, the Government estimates that we have over ten hundred billion tons, or over 14 per cent. of the visible coal supply of the world, here in Alberta. The known coal reserve of the world by countries, is as follows: United States 52 per cent., Canada 16 per cent., China 13 per cent., Germany 6 per cent. At present 83 per cent. of the coal consumed is mined in the United States, Great Britain and Germany.

Possibilities of the Dye Industries

We should not think of this coal only as a fuel, but we should look beyond to see its possibilities. The Germans have developed the coal tar to such an extent that they are able to extract as high as $20 worth of by-product from a gallon of raw material.

No experiments, to the writer's knowledge, have been made to determine the nature and yield of volatile compound to be obtained by distilling lignite and the possibilities of using these residue from distillation as solid fuel.

Benzol is one of the products which could be obtained from lignite. This can be used in gasoline engines, and in the manufacture of dye stuff, ammonia compound and chemical fertilizer.

Over 900 dyes of commerce, and 4,000 colors can be made from coal tar. The source of the German monopoly of the dye industries is their large lignite coal field.

It is a well-known fact that the British Empire, as well as all neutrals, have been greatly inconvenienced by the stoppage of the German supply, so that we here in Alberta should do our best to give this industry a start, and try and develop it on a substantial and conservative basis.

Fixation of Atmospheric Nitrogen

The world feeds itself on the first six inches of earth on the terrestial globe. If we want it to keep on feeding us we must be careful of its fertility. As the population increases so do the requirements.

Nitrate (Saltpetre) is the first element of the soil to give out; it can, however, be made from the air. The only source of it at the present time in the form of mineral is the Chilean nitrate bed. This source, however, is limited, and it is estimated that it will not last more than 20 to 50 years before it gives out.

Essential of War and Agriculture

Farming is a peaceful occupation which requires nitrate. The most strenuous occupation of all, that of war, must have nitrate to keep it going in the form of explosives. Previous to 1914 Germany got its nitrate from Chile and Norway. The Norwegian Nitrogen Company had 260,000 h.p. devoted exclusively to the fixation of atmospheric nitrogen, and 280,000 h.p. more projected which has likely been constructed under the pressing demand of Germany for nitrate. The water power development was undertaken solely for the process and furnaces were invented. It is safe to say that great improvements will take place in the manufacture of nitrate as in other lines.

In 1910 in the French Alps there were water power plants aggregating 475,000 h.p. projected. All this power was to be used in the electro-chemical and electro-metallurgical work.

It has been reported that Germany, through force of necessity, has had to install plants for the fixation of atmospheric nitrogen of 118,000 tons capacity since the war started. Previously it had a capacity of 22,000 tons per year. I am inclined to believe that the Germans must have improved the efficiency of their furnaces, as it was from 2½ to 3 per cent. efficient previous to the war.

The consumption of saltpetre in European countries in 1912 amounted to 1,611,000 tons. The per capita varied from 44 pounds in Belgium, the most intensely cultivated country in Europe, to 6.0 pounds in Norway.

The United States Federal Government appropriated $20,000,000 for the establishment of a nitrate factory. It is estimated that with that amount they will be able to construct plants of a yearly capacity of 140,000 tons. Strong efforts are being made to have this established in the west close to the alunite or phosphate beds of Utah and Wyoming.

We in Canada have the necessary elements to make the most highly concentrated complete fertilizer known. Near Banff we seem to have alunite beds of larger extent than those at Utah and Wyoming.

Cheap Power Essential

Cheap power is essential for success in this industry. Power costing $16 per horse power per year will produce nitric acid for $44 per ton. This acid is worth $95 per ton in New York. Nitrate worth $70 per ton can be manufactured at about the same proportionate cost. A margin of $51 per ton should be enough to induce capital to be expended freely on this industry.

The manufacture of nitrate is only one of the products which can be made from the air by means of the electric furnace. The following gives an idea of what can be manufactured from the air, and the addition of a few elements abundant in Alberta, ammonia, ammonium sulphate, nitric acid, calcium nitrate, potassium nitrate, barium nitrate, cyanides, hydrocyanic acid, calcium carbide, cyanimide, etc. This is not an exhaustive list; it could be lengthened almost indefinitely with products more or less valuable.

In all that has been said about the electro-chemical industry it might be well to say that only a few men are employed in this industry. The electro-chemical industries are interrelated, and once they are established in this province it would be a matter of a few years only before we would have a large variety of them doing successful business.

Possibilities of Pulp Wood

Pulp mills should be strongly attracted to this province. I have seen a newspaper report which stated that we had a billion cords of pulp of all kinds in Alberta. Beside raw material, power is next in importance. We have a good market in the three western provinces, also the Western States. The total production of newsprint paper in the United States for 1915 was 1,001,662 tons; for Canada it was 428,856 tons; our production is nearly 50 per cent. of that of the United States with a population of about 8 per cent.

Raw material is being rapidly exhausted in the United States. It has been estimated by Mr. Gifford Pinchot, former chief of U. S. Forestry, that at the present rate of cutting the stand of spruce in the State of Maine will last for about thirty years; New Hampshire twenty-five years; New York less than ten years. Wisconsin has no reserve and manufactures nearly 300,000 tons a year. This and other factors will cause our neighbor, the United States, to seek new sources of supply, specially those states west of the Mississippi River, and will force manufacturers to come and locate their mills in the province of Alberta.

West of the Mississippi River the total mill capacity does not exceed 150,000 tons per year. It is safe to say that this section does not produce anything like its consumption. We are surely in a favorable condition to compete with either Eastern or British Columbia manufacturers. In one instance we have the distance in our favor; in the other we have the trans-mountain freight rate. We are on the plains and have the railway lines running north and south.

We need not be afraid of duty, as Canada exported in 1910 $15,000,000 worth of pulp; in 1916 our export of paper of all kinds will reach $38,000,000. In six years our exports increased more than 150 per cent. Another thing which is in our favor is that the manufacturing cost compares favorably with that of the United States. In 1910 it was as follows: Average cost of mechanical wood pulp $3.65 less in Canada than in the United States; sulphite pulp $5.48; newsprint $.14 per ton. The cost of manufacture in this province should not be any more than in British Columbia.

Our poplar should play an important part in the manufacture of better quality paper. It is not a generally known fact that poplar can be made to take the place of rags in the good quality paper. While by far the largest amount of wood in this province is spruce, poplar represents a good percentage of the total available. It can be used advantageously in the making of the better quality paper by mixing it in the following proportions: 60 per cent. poplar pulp and 40 per cent. spruce pulp. This mixture is the one used in the manufacture of writing paper.

Openings for Flour Mills in Alberta

In 1915, according to the Provincial Department of Agriculture, we produced and exported 60,000,000 bushels of wheat. The figures for 1916 are not yet available, but it is fair to estimate that they will not be as great as they were in 1915. However, the farmer should get as much money out of his crop, as he is selling at an increased price. It requires approximately 40,000,000 bushels of wheat to feed the Canadian population, and it is likely that within the next ten years the export of wheat from this province will greatly increase.

By-Products

In the milling industry by-products, bran, middlings, and shorts, amount to from 15 to 20 per cent. This is valuable for feeding dairy stock and fattening. We have the stock in Central Alberta and should make efforts to increase the milling capacity. In 1912 we could mill in Alberta 7,435 bbls. per day; for the whole of Canada, 125,000 bbls. There is, or was, discrimination in ocean freight rates between flour and wheat. The spread as between wheat and flour in 1912 averaged 3.83 per cent per hundred pounds. In the early part of 1913 it amounted to 7 per cent. This the transportation companies claim is due to the way flour has to be handled.

Larger Mill Capacity

It is essential that we should have larger mill capacity, and do the majority of our export of wheat in the form of flour. This would have a regulative effect on the market. At the present time all our wheat is rushed to the head of the lakes, and put on the market within two months after the harvest. It is a hard task on the transportation companies, and such a large quantity of wheat offered has a tendency to reduce the price at which the farmer sells. If we had mills to do our milling in this country the supply would be bought and stored in internal elevators and moved as required by the miller the year around; thus, our wheat would not have to be shipped in such a hurry and the farmer would have the benefit of higher prices.

The Panama Canal

Now that the Panama Canal is in operation, Alberta should be in a position to secure more advantageous rates than formerly. When the war is over shipping via the Panama Canal should be greatly stimulated. This route, however, is likely to offer disadvantages which will have to be overcome; that is, wheat is liable to sprout going through.

due to the dampness and the tropical heat. Flour, if properly stowed away, would not be subject to damage.

Hydro Power for Milling

The cost of steam power at Minneapolis amounts to five cents per barrel. Water power costs only one cent per barrel. This is a small item on one barrel of flour, but if you multiply that by one or five thousand a day in the course of a year it amounts to gigantic figures.

A Provincial Undertaking

The building of a province-wide hydro-electric system such as contemplated in this article should be a government undertaking. Unfortunately, our experience with provincial enterprise has been costly.

Reasons Why

There are several reasons why this should be a government undertaking. Perhaps the most valid is that of promotion and financing. The usual procedure in undertakings of this nature is for the owner of water power rights to try and interest financiers to take up the financing. Of course, as the promoter owns the rights, he is looking to make himself rich in one stroke. Then if the project looks good the financier will undertake the financing. Again, these men will not do the financing for the love of it, and they will try and get all they can. This is what is being done in Edmonton at this writing. In many instances the cost of promotion and financing amounts to as much as $9 per horse power year. A private company generally has more or less franchise rights, and other side issues, so that the capital has to be increased to purchase these side issues.

Cost of Money

The usual cost of money to a large hydro-electric development is 7 per cent. Government bonds in normal times should not carry more than four or five per cent. interest. A saving of over 22 per cent. on interest charges is effected. With a private company the water rights are secured for a limited number of years. The promoter generally estimates the cost of power, and charges enough, so that at the expiration of the water right the bond will have been paid and a large block of stock will have been withdrawn. Taking in everything a water power plant costing $5,000,000 will have to earn interest on practically $10,000,000 and wipe out the whole of this amount in less than 50 years of operation. This has to be paid by the consumers, and is one of the reasons why a number of good hydro-electric propositions are not taken up.

With the government, on the other hand, the enterprise is not for profit, but for the good of the people. They should have no trouble in borrowing money at 5 per cent. or less. A comprehensive scheme can be mapped out, and gradually developed until all important sections of the province are thoroughly covered.

Immediate Profit

Private interests as a rule are looking for immediate profit and a project is only partially developed on account of the cost. This is a common occurrence. With the government, while all expenditure should be done on a conservative basis, yet if the ultimate result warrants it no part of the project is omitted, but the whole is properly put up.

Ontario Hydro

The province of Ontario has made a phenomenal success of its hydro, and the time is at hand in this province for a scheme as outlined in this article. No doubt the hydro-electric systems of Ontario have played an important part in the manufacturing done in that province. This year it has done 45 per cent. of the total manufactured material in Canada in 1916.

Conclusion

In closing it might be remarked that it is the practice in undertakings of this kind to wait until the revenues necessary to defray fixed charges are visible. This will have to change, and the time is near at hand when we will do the same as is done with railways. If we had waited for the Indian and half-breed to petition the government for a railway through the western plain it is more than likely that we would not be here tonight, but would be in some other part of the world. The Canadian Pacific Railway, one of the finest on the continent, would not be. Let us follow the good example of our forebears and undertake the construction of a comprehensive hydro-electric system in this province. Revenues sufficient for fixed charges are visible, and it is only a matter of proper financing and organization. There is no reason why we should not be able to do as well as they are doing in Ontario, get the system going and go after the load.

Other Reasons

The general opinion is that the war will not last much over this year. This is another reason why this should be proceeded with at once. If the war ends this year, what will we do with our 35,000 returned soldiers? Strong efforts are being made to return these men to the farms, but it is preposterous to think that we can make farmers of all these soldiers. It would be desirable; it is not likely possible.

Then, if we want to do something let us plan ahead and create opportunities. The construction of a plant such as contemplated here would occupy several years and employ a large number of men. The offer of cheap power would attract manufacturers of all kinds to this province; thus creating opportunities for the industrious. Looking at it from all angles, I cannot conclude otherwise than that the time is here for us to proceed with the organization of this undertaking at once so as to have it under way when the war is over.

Canadian and American bankers seem to be of one mind. Canada should have no trouble in financing legitimate enterprise.

Large Order for Chippewa Development

The Hydro-electric Power Commission of Ontario have placed contracts for their supply of timber for the development work at Chippewa, Ont., through W. J. MacBeth, Toronto. Mr. MacBeth reports that the contracts cover between seven and eight million feet of timber, including hemlock, yellow pine and B. C. fir. The timbers will vary from 2 x 4 in. to 12 x 14 in., and their length will run from 10 feet up to 40 feet. The order includes about 3,300,000 feet of yellow pine, 3,500,000 feet of hemlock and 170,000 feet of Douglas fir.

Are You Doing Your Part?

The Joint Committee of Technical Organizations has sent out follow-up reminders to men who failed to respond to the first request for information. It is unfortunate that this should have been necessary, as the personal financial strain upon certain individuals is already heavy. The Committee asks your assistance in the form of a prompt reply. Give them your help to this extent. It will only take a few moments and—it's war work.

Representatives from Etobicoke, Mimico and New Toronto, have protested to the government the proposal to allow the Toronto and Niagara Power Company to construct a 25,000 volt transmission line near Islington on the C. P. R. They are opposed to this movement on the ground that it may interfere with future Hydro-electric development in that district.

Independent Laboratories in the Industries

Industrial and Scientific Research Distinguished—Require Different Equipment and Different Laboratories Industrial Research must be Self-supporting

By Clayton H. Sharp*, Ph.D.

The importance of laboratory work in connection with our national industries is coming more and more to be recognized, and there is no little discussion at the present time of suitable ways and means for promoting it. With the sharpened competition which must ensue at the close of the war which is now paralyzing the peaceful industries of the world, any and all means for increasing our industrial efficiency will be considered with a seriousness which in the easy-going times of the past has not been accorded to them.

Our great manufacturing organizations are for the most part quite awake to the fact that laboratory testing and research are necessary and indispensable adjuncts to the growth and development of their industries. They realize that it is to the laboratory that they must look for radical or fundamental advances in the materials, methods and processes of production. They have established splendid laboratories and have attracted to them some of the greatest scientific men of the country. The product of these laboratories has been of enormous value—a value which cannot be measured in money, for it includes engineering and scientific discoveries which become the permanent possession of the human race and add to the prosperity and happiness of all future generations.

The manufacturers of smaller resources do not, however, make a correspondingly large use of laboratory assistance. This may be ascribed to two causes: first, that they are not so fully aware of their own need for laboratory assistance and of the possibilities of laboratory work in increasing their efficiency, bettering their product and broadening their scope; and second, because of practical difficulties in securing such laboratory facilities as correspond to their needs. It is with the latter phase of the situation that this paper is intended primarily to deal.

Laboratory or research work is commonly divided into two classes, both of which are important in connection with our national industries. First, there is the work in pure or academic science—the work primarily of the university. Second, there is the work in applied science, or in industrial research. Dr. J. J. Carty in his address as President of the American Institute of Electrical Engineers, has very clearly and very aptly drawn the distinction between research in pure and in applied science when he said that it lies neither in the subject matter, which may be identical, nor in the methods, which may be the same, but in the motive. To quote his words:

"Industrial research is always conducted with the purpose of accompanying some utilitarian end. Pure scientific research is conducted with a philosophic purpose, for the discovery of truth, and for the advancement of the boundaries of human knowledge.

"The investigator in pure science may be likened to the explorer who discovers new continents or islands or hitherto unknown territory. He is continually seeking to extend the boundaries of knowledge.

"The investigator in industrial research may be compared to the pioneers who survey the newly discovered territory in the endeavor to locate its mineral resources, determine the extent of its forests, and the location of its arable land, and who in other ways precede the settlers and prepare for their occupation of the new country."

Evidently the industrialist who, to carry the analogy further, may be likened to the settler in the new territory, is dependent upon both classes of investigator; on the investigator in pure science because it is he who indicates the existence of a field heretofore unknown; on the industrial investigator because it is he who discovered the commercial possibilities which the field contains.

The organization which is pre-eminently fitted to carry on the primary work of pure scientific investigation is the university. It is to the university that we must look to discover and to foster the men having those rare and peculiar gifts of imagination, of transcendent patience, of unselfish devotion, which go to make up the explorer into the unknown regions for the extension of physical and chemical science. It is the university which must furnish these men the surroundings and the facilities which are required for the prosecution of their work.

For the adequate pursuit of industrial research work, however, it is necessary to look to organizations constituted differently from the university. Industrial research having as its end the accomplishment of a definite result of commercial value accruing primarily only to the promoter of the work, it is evident that an institution organized like the university primarily for an educational purpose, and supported largely by endowments or by public funds, cannot justly devote any considerable portion of its energy or of its resources to any purpose which is not for the benefit of the public at large. The technical schools in this respect are in the same class with the universities, with the important exception that a technical school is in general better situated for the conduct of industrial research work than is the university from the fact that its training is along industrial lines. Hence we find that many of the great industrial corporations in this country have, as has been said, met their own needs by establishing their own private industrial laboratories. For the industries at large, however, this affords no adequate solution of the laboratory problem, for it does not apply to the multitude of concerns, individually smaller than the great corporations and unable each by itself to support economically and efficiently an adequate laboratory, but in the aggregate of enormous industrial importance. The importance of laboratory work to the smaller concerns is relatively just as great as to the larger ones, and the problem is, the best means of supplying their needs in this particular.

One possible solution is for the smaller manufacturer to take his laboratory problems to a technical school for solution. This plan, while it may work out admirably in many cases, is open to the objection which has been mentioned above, namely, that the funds of the institution, being given for a public purpose, should not be diverted to private ends. However, it may be urged against this that it is to the advantage of the technical school to take on a certain amount of industrial work, not only in research, but also in testing. Such work necessarily brings both instructors and students into contact with certain practical problems of the outside industrial world, a world of which they know much in theory but too often but little in practice. The effect of this contact cannot but be broadening and helpful to the technical school and to its students, and if this advantage is sufficiently substantial, the theoretical disadvantage of diverting the attention and the resources of the institution to a limited extent to matters which are particularly the affair of private outside individuals or corporations is more than counterbalanced. Added to this advantage to the technical school are certain others, among which may be mentioned that incidentally the frequently inadequate salaries of the body of instruction in the technical school are to some extent augmented and the instructors thereby put into a position more nearly in accord with the demands which are made upon them. To the industrial concern a recourse to the laboratory of a technical school may offer the advantage of furnishing a service for a smaller expenditure than would be necessary if all of the overhead and incidental charges were included, which under similar circumstances a commercial organization would have to make.

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As against the advantages so outlined there are certain disadvantages which must be given careful consideration and due weight. We have noted that taking on a piece of industrial work has the effect of bringing instructors and students into contact with practical industrial problems and thereby broadens their vision and increases their usefulness. To the industrialist, however, who has a problem to solve, the very lack of contact with the actualities of practice very greatly lessen the value of the technical school as an organization for the accomplishment of his purpose. Every technical problem is surrounded by limitations and special conditions which may not from an academic standpoint appear to be of controlling importance, but which if not given their practical weight render any solution nugatory. Considerations of cost, of the intellectual and psychological limitations of workmen, of transportation, or market conditions, of company policy, of technical and commercial usage in the field—any or all of them may have their influence on the result. The technical school men, if less in touch with practice, are evidently at a disadvantage in the solution of problems involving these elements. The technical school, being organized and equipped for purposes of education and not for purposes of testing or industrial research, is frequently at a disadvantage on account of the limitations of its laboratory equipment, the amount of power, etc., available, and on account of the lack of a business or technical organization especially designed to prosecute with directness, accuracy and engineering common-sense, industrial problems which it never was designed to handle. It must be remembered that while many discoveries are made by laboratory experiments on a small scale, many of these are not applicable to industrial exploitation for the reason that elements which in small-scale experimentation are of negligible importance, often become controlling factors when the scale is changed to correspond to practical production. A chemist in his laboratory may effectually close a flask with a cork; a similar procedure does not apply at all to a spouting oil well. He may evaporate to dryness a dilute solution for the purpose of recovering a small residue and never once think of the gas which he uses in the process. If he were dealing, however, with the same operation on a scale ten thousand times as big, the matter of fuel and of containing vessel might offer insuperable obstacles to commercial success. Small-scale experimentation teaches but little regarding the proper design of a switch to open a high-tension power circuit. Hence apparatus which is quite adequate for the small-scale work of the laboratory of instruction may be entirely inadequate when experiments are required looking toward the industrial application of a process.

In speaking of this feature of industrial work in educational institutions, Dr. Steinmetz, in a recent address said:

"Unfortunately this limitation of research work in accordance with the available facilities is not always realized, and especially educational institutions not infrequently attempt research work for which industrial laboratories are far better fitted, while research work for which the educational institution is well fitted, which the industry needs but cannot economically undertake, is left undone."

Prof. James Swinburne, in a letter on Science in Industry, delivered very recently at Kings College, has pointed out that the instructor in technology tends as time goes on to be less and less in touch with practical conditions and more of an academic scientist.. This is for the reason that in general only those who have less taste for engaging in the practical work of industry are likely to take up the teaching profession, and their own successors are as a general thing the less practical ones of their own students. The academic scientist, on the other hand, is a master of his subject, for his science, like himself, is academic, and in his own field he is pre-eminent. Thus the tendency of the technologist to become academic is a tendency for him to follow his proper bent and to employ his energies in the direction in which they will be most effective.

Since to refer the problems of the industry to the technical schools for investigation does not offer a satisfactory solution of the problem, some other way out must be sought. This may be found along the lines indicated by Dr. Carty when he said:

"One of these is for the manufacturer to take his problem to one of the industrial research laboratories already established for the purpose of serving those who cannot afford a laboratory of their own. Other manufacturers doing the same, the financial encouragement received would enable the laboratories to extend and improve their facilities so that each of the small manufacturers who patronizes them would in course of time have the benefit of an institution similar to those maintained by our largest industrial concerns.

"Thus in accordance with the law of supply and demand, the small manufacturer may obtain the benefit of industrial research in the highest degree and the burden upon each manufacturer would be only in accordance with the use he made of it, and the entire cost of the laboratories would thus be borne by the industries as a whole, where the charge properly belongs."

Thus to the independent laboratory is assigned an important place in the engineering industries as providing for the smaller manufacturer laboratory facilities comparable with those enjoyed by some of the great corporations. To fulfil properly these functions the independent laboratory must be adequately supported, properly manned and abundantly equipped. Its staff must be organized on broad lines. Its engineers must be familiar with the practical and commercial features, as well as the technical details, of the work which they encounter. It must include physicists and chemists accustomed to look at the fundamental features of the problems presented and to bring to bear upon their solution the methods and the point of view which are inculcated in the university laboratories of research, for the application of fundamental scientific principles to the solution of the problems of industry underlies all true industrial research. The fees charged by such a laboratory must be adequate to cover not only all expenses, but to yield a sufficient profit as well, for:

"Unless industrial research abundantly supports itself, it will have failed of its purpose."

In return for the fees so paid it must deal with its clients in a highly confidential manner, conserving to them individually all of the results of the work for which they are paying. It must be prepared to turn over to its clients the inventions and patents which are the direct outcome of any specific piece of work. It must organize its work efficiently, so that its costs are as low as is consistent with good work and so that the results are obtained without undue delay. As to equipment, this undoubtedly must be large. The variety of problems which a laboratory of this sort will have brought to it will be of such scope that a great variety of instruments for measuring and for manipulation must be at hand. A very large supply of electrical power is an absolute requisite. These conditions interpose serious obstacles in the way of establishment of laboratories of this character. Unless the laboratory is organized through the co-operative efforts of a considerable number of industrial corporations operating in the same or in similar fields, a difficulty is sure to be encountered in insuring beforehand its proper support. To some extent a laboratory of this sort must from its very inception possess an equipment representing a very considerable investment. Unless therefore the financial support is insured beforehand, no little faith is required on the part of those investing their money in it. When, however, it has been possible to establish a laboratory of this character, the scope of its work may be very large. It may, and should, include not only industrial research proper, but ordinary and routine testing, such as is required not only by manufacturing concerns, but also by consulting engineers and others. It should be prepared to make acceptance tests of manufactured articles on behalf of purchasers and a considerable part of its activities may lie in this direction. It should offer facilities to engineers, inventors and other would be experimenters to carry on laboratory work of their own under its roof, and should make available to them all its own facilities. In carrying out work of this great scope in an adequate and proper manner the independent laboratory will find itself side by side with the technical school as one of the potent factors of industrial progress. The staff of such a laboratory will become increasingly efficient through the practical solution of problems of many kinds. The apparatus and other equipment will necessarily take on a diversified character such that new and unusual problems presented can be undertaken without the purchase or construction of special apparatus. As compared with under-equipped and insufficiently manned laboratories which with a most laudable spirit individual manufacturers may establish for their own use, independent laboratories, supported by formal cooperation, should be far more efficient both as regards the cost of maintenance, the character and extent of the equipment, and as to the practical result to the industries, because of the product of the researches conducted therein. In the last analysis the availability and utility of such laboratories depend on the amount of material support which the industrial world is willing to accord to them.

Galvanized Iron for Transmission Lines

Owing to the greatly increased price of copper and aluminium wire, the use of galvanized iron is becoming much more common for transmission work. Its use to date has been largely on short lines on the outskirts of the larger distributing systems. Particularly the iron wire has shown its adaptability where the load is small.

Up to the present time comparatively little has been known of the characteristics of iron wire as an electrical conductor, but tests are now going forward at different points and the experience gained by pioneers in the use of iron wire, in actual distribution, will, of course, add materially to the sum of our information. For example, the Hydro-electric Power Commission of Ontario have not only utilized iron wire in certain of their outlying distribution areas, but they are conducting test experiments on a short line set up for this purpose. In our issue of February 15 we reproduced a paper by Mr. H. B. Dwight, outlining the situation pretty fully to date, and the Electrical World of February 10 has an article describing an iron wire line recently constructed in the middle west, which throws some additional light on this somewhat obscure problem. The line is about 31 miles long and supplies two towns; one with a population of 300, en route, and the other with about 800 people, at the end of the line.

This line operates at 22,000 volts, 3 phase, 60 cycle, and is designed for 50 kw. peak load. Transmission is by No. 6 EBB galvanized wires, mounted horizontally, four feet apart, on steel arms. Thirty-foot steel poles are used, spaced 300 feet apart and set in concrete. Every half mile one pole is head-guyed both ways in the direction of the line. Corner poles at railroad crossings are double-arm, a thirty-five-foot pole being used at the crossing. At the time this line was designed, no information could be located concerning the electric characteristics of iron wire. EBB wire was chosen on account of its low resistance, and the fact that the current would not be more than 3 amp. per phase. The government report on iron wire for transmission purposes indicated that No. 6 EBB wire would have a lower effective resistance than the other grades for currents up to about 3 amp. Beyond this value the better magnetic properties of the harder wires give them the preference. More recent information indicates that the line loss will be greater than originally estimated, but it will not be sufficient to make any considerable difference for some time to come. In a short time instruments will be available at both ends of the line for conducting adequate tests to determine its characteristics. Curves taken at the end of the line show the voltage excessive at times, but seldom does it drop below normal.

Unexpected difficulties were experienced in calculating the sag, as no tables or curves for this class of work were available. The high modulus of elasticity and low coefficient of expansion of iron makes the use of standard formulas very difficult. This line was designed to withstand a 0.5-in. coating of ice and a 30-mile wind pressure, or a loading of 0.7 lb. per foot. The stress allowed with a maximum sag of 6 feet at zero deg. Fahr. the temperature of maximum loading, is 75 per cent. of the ultimate strength of the wire. Close examination of the problem shows that the unstressed length of the conductor even at 60 degs. Fahr., is less than the span length.

As the principal item favoring the use of iron wire is its low cost, the following figures for this 31-mile line, showing a total cost per mile of less than $700, has a very special bearing:—

DISTRIBUTION OF TRANSMISSION LINE COSTS
(Distance Dodge City to Bucklin, Kan., approximately 31 miles.)

	Total.	Per mile.
Engineering and survey	$ 828.59	$ 26.73
Pole rights	238.30	7.69
Total labor	2,619.59	84.50
Camp expenses and meals	592.54	19.11
Teaming	717.49	23.15
River sand, gravel, and cement	356.81	11.51
Insulators	840.03	27.10
Pins	469.30	15.13
Wire (95 miles No. 6 EBB)	3,368.93	108.67
Steel poles (total, 557, including 23 guy stubs)	7,856.31	253.43
Guying material	380.31	12.27
Wood poles and line material	287.90	9.28
Transformers, switches, and arresters	2,739.63	88.37
Substation material	193.11	6.23
General expense	107.25	3.46
Total	$21,596.00	$696.64

DISTRIBUTION OF LABOR.

Rebuilding of wood-pile line in town to accommodate high-tension line from city limits to plant	$ 391.30
All work connected with setting 539 steel poles ready for wire	1,133.95
Stringing wire setting anchors and attaching guys to above poles (about 29 miles of line)	470.64
Building towers and finishing up last mile of steel line	623.30
Total	$2,619.59

The Dealer and Contractor

Light and Periscopes — The Problem of Invisibility—Its Application to Undersea Craft

By Mr. J. F. Heffron

From Simon Lake's curious craft, the "Argonaut," built at Baltimore in 1898, to the German underseas-boat "Deutschland" which emerged in the waters of Chesapeake Bay after a journey across the broad Atlantic during the month of July last year, is perhaps a far cry, and cannot be regarded otherwise than as an extraordinary event in marine history. It will therefore be of interest to consider several problems in regard to light and its relation to the successful operation of the submarine.

The present war has undoubtedly demonstrated the great value of the underseas boat in practical naval operations, and it has as well demonstrated its shortcomings. The British Navy, since the beginning of the war, have captured or destroyed, we are told, not far from 150 foe submarines; they have been successful in this respect principally because the fact that great numbers of British trawlers, launches, torpedo-boats, and other light and swift craft are constantly engaged in patrolling British waters. And the crews of these vessels are constantly on the alert, scanning the surface for one small, but nevertheless conspicuous, object. This object is the submarine's periscope, on which its navigators must depend almost entirely for their bearings when submerged beneath the waves.

This instrument, projecting a few feet above the surface of the waves, constantly acts as a concrete sign board for what is underneath. Once the telltale emblem is sighted the surface patrolling vessel rushes speedily in its direction. There is very often an impact, a crash, and another German submarine with its crew are sent to Davey Jones' Locker. Or the submarine being unable to travel much faster than fifteen miles per hour under water, is surrounded by the swift surface craft and a net is lowered in front of it to which is attached bombs which dispatch the unfortunate craft when it strikes the obstruction.

Clever as the Germans conceive themselves to be, they have devised no scheme to make the periscope invisible. Could they perfom this little operation, they would greatly increase the destructiveness of the submarine.

It is perfectly clear, of course, that the submarine cannot dispense with its periscope, for then it would be obliged to travel around in the dark; likewise, the periscope cannot be submerged, for then its usefulness would be destroyed.

If this seemingly impossible problem is solved, the periscope must be permitted to elevate itself above the water with impunity; it must stand up in full view and yet be unseen. Mr. William A. Mackay, a mural decorator of New York, seems to have recently solved this problem which vexes the captain and the crew of submarines.

Mr. Mackay has pointed out that there was but one way in which a periscope sticking two or three feet out of the water, can be concealed. It usually has for a background the sea-blue water. Clearly, therefore, the thing to do is to paint the object the color that most resembles that water. That is the customary plan adopted to make objects invisible. Battleships are painted gray or streaked with gray with the idea of making them obscure. Soldiers are dressed in khaki, modern military science believing that this shade blends most successfully with the landscape. The Deutschland, mentioned above, sailed out of Baltimore recently with her sides painted to represent the sad sea waves, even the white-caps being faithfully represented.

Now Mr. Mackay, being an artist, is used to studying landscapes and mixing colors. He has spent many days in the open, reproducing on canvas the colorful beauty of the external world. His studies in chromatics have taught him the difference between an artificial pigment, as it appears on the artist's palette, and the effect of color which the human eye absorbs from nature. One being simply paint—a tangible mineral substance, while the other is simply light, arranged in combinations that produce certain impressions on the human brain which we term color.

When the artist paints a blue sea upon his canvas, that blue sea is paint, not light. It will always be blue, and cannot conceivably, under any circumstances, be anything else. But it is quite different with the blue of the sea. If you take some of this sea water in your hand it no longer appears blue at all—it is apparmently colorless, and translucent, just as is the water you draw from the tap. Without going into the technical reasons given to explain what makes this clear fluid, when seen at a distance, give us the wonderful blue of the sea, we may say that this impression of color is due to nothing but light.

Light, as we are aware, is a combination of several colors. Two of these colors under the conditions of the sea, combine, and the etheric vibrations that result give the brain the impression of blue. But blue, in the sense of the artist's palette, does not exist there. So that the German, when he paints sea-blue waves on the side of his submarine, is attempting to make the mineral paint of the Fatherland compete with the vibrations of the spectroscope, the result being that he makes his ship even more conspicuous than it was before.

Mr. Mackay, in his attempt to overcome this difficulty, does use paint, but in quite a different way. Two colors of the spectrum, he explains, green and violet, make the sea-blue. Therefore, the proper thing to do is to decorate your periscope with these two colors. The vibrations of the two will then attack the retina, and, mingling with each other, give the brain an impression of sea blue.

To demonstrate his theory in a concrete manner before a gathering of naval officers in the Brooklyn Navy Yard, Mr. Mackay drew the attention of his audience to a large board removed some distance away, and requested his audience to note the appearance of it. Everyone present received the same impression of color. It was, all agreed, a beautiful sea-blue. Taken out some distance on a boat, and held up with the sea as a background, it disappeared from view, gradually melting away, until at a comparatively short distance it blended so entirely with the blue sea water that not a vestige of it remained. Had it been the periscope of a submarine, that vessel would have undoubtedly been absolutely concealed. Upon closer inspection this board assumed the appearance of a checker board. The spaces were painted alternately a glaring green and violet, which sometimes is also employed in producing colored photographs. The vibrations of these colors, especially on a ship in motion, so affect the optic nerve as to produce practically the same color as the blue sea. As a consequence, the two blend so that the object disappears; in other words, merges into the background.

This method of painting is now being adopted not only for the periscopes, but for the bodies of submarines, in the United States Navy. Experiments of this kind are also being made with marine and navy aeroplanes and hydroplanes. Quite recently a fleet of submarines, decked out in these gaudy colors, made a trip from the Brooklyn Bridge, New York, to Norfolk. One of the ships lost track of the rest of the fleet, which became invisible because of its curious decorations, and was obliged to make the voyage alone.

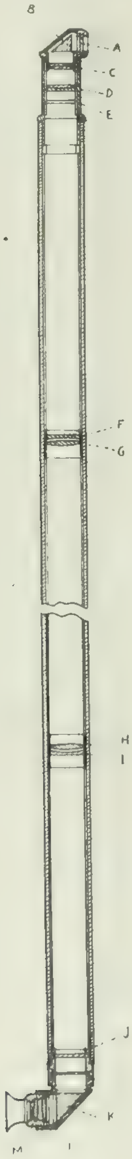


Fig. I.

The submarine is a terrible agent of destruction under present conditions, and the additional horror it would inspire were the periscope as invisible as the ship itself, is difficult to imagine.

Another problem in connection with the submarine's periscope, which has received considerable attention of late, is the problem of light transmission from the head prism or object glass which revolves to sweep the horizon, through the many optical elements employed to bring the image observed down to the stationary eye-piece—within the submarine itself, where the observer is stationed. As a matter of fact, in some of the modern periscopes for submarines, barely twenty per cent. of the light reaches the observer's eye.

In considering this matter it might be well for us to describe briefly the construction of a periscope.

This cannot be done better than by quoting from Mr. F. Kollmorgen's paper on Light Transmission Through Telescopes, given before the New York Section of the Illuminating Engineering Society. In this paper Mr. Kollmorgen deals with the loss of light and brilliancy in telescopes and similar optical instruments, caused by reflection and absorption, and also deals with the means of changing the reflecting power of glass surfaces by chemical treatment.

He tells us that, "Roughly speaking, the object of a periscope is to produce a large field of view through a long, narrow tube at comparatively low magnification. It would be obviously impossible to construct a periscope on the principles of an ordinary astronomical or terrestrial telescope, as the lenses would assume enormous dimensions if a large field of view were required. One has therefore had recourse to a very simple but efficient plan.

"As you probably all know, the principle of a telescope is to take an object appearing from the point of vision under a narrow angular view, and produce it to the eye under a wide angle. The ratio of these two angles constitutes the magnification of the telescope."

Now no doubt the reader has looked through a telescope in the reverse direction; that is to say, through the objective lens, and has observed that the telescope shows objects that really appear under a large angle reduced to a small angle of vision. Therefore, if we take two telescopes of the same magnification and place them with the objectives facing each other, the first telescope will take a large angle of view and reduce it to a narrow one; while the second telescope will receive this narrow angle and widen it out again to the wide angle originally received by the first telescope. This, in brief, is the principle employed in the construction of a submarine periscope.

Fig. 1 shows the optical construction of one of the simplest forms of periscope at present in use, which drawing, however, leaves out the prisms, which serve only to deflect the line of sight from horizontal to vertical and back again to horizontal direction. Mr. Kollmorgen tells us that the upper or reducing telescope would be composed of the elements C, D, E, F and G, in which C and D, in combination constitute the objective. E is a ruled glass plate serving as a telemeter which is placed in the joint focus of objective and eye-piece. This telescope reduces the large angle of the field of view to one about fifteen to twenty-five times smaller, and the narrow angle easily passes through the long, narrow tube of the periscope. The approximate dimensions of the periscope at present in use is about 22 feet in length, tube 5 to 6 inches in diameter, tapering at the head to about 2½ inches.

By multiplying the coefficient of each optical element, we find that this periscope can transmit only about 25 per cent. of the light originally received. Mr. Kollmorgen further informs us that if we take into consideration the very considerable thickness in the aggregate of all the optical elements, we find this in turn produces a further loss of 23 per cent. approximately. Therefore, the total amount of light received by the observer's eye would only be about 19 per cent. of the original amount received by the periscope. It is therefore easily seen that any process which can lessen this loss of light would constitute a great advantage.

The actual loss of light, we are told further, is not the only drawback. There is, in addition, a loss of brilliancy and contrast in the image which is quite appreciable. The cause for this is that the light has undergone two or four reflections from the glass surface, causing what might be termed double reflection; which, of course, does not add anything to the brightness of the image, for it does not come to the focus at the proper point, having its own focal points, and therefore being out of focus at the place where the true image lies. It therefore forms a veil of stray light rays over the image which detracts from its brilliancy and clearness.

The desirable thing, therefore, is to affect the glass surfaces, if possible, in such a way as to reduce the amount of reflection. Prof. Wood, of Johns Hopkins University, some years ago made the remarkable discovery that it is possible to increase the reflecting power of a surface by a coating of a thin solution of commercial collodium. This coating, when properly placed on the glass surface, produced a degree of reflection quite out of proportion to the refractive indices of either the glass or the collodium itself. This idea has been worked upon by various scientific men at different times, and an effort has been made to assign reasons for this increase in efficiency under different conditions. We cannot well go into, in detail, the various phases that the idea awakens, in the small space at our disposal, but suffice it to say that this matter of molecular conditions at a surface is one of the most interesting and least investigated groups of phenomena in science.

In technical work this matter is now receiving some attention, for it is well known that in chemically silvering glass the glass surface must be absolutely clean. To further quote Mr. Kollmorgen, "We clean it with water, alcohol, ether, and feel convinced that it is now absolutely clean; yet, when it comes out of the silvering tank we find that the silver has not attached itself to the glass at all, but that there has been some film still adhering to the surface. We clear it again, this time with potash, tin oxide, tin chloride, or French chalk, and we find on pouring water over it that certain parts will not allow the water to stand on them, but have a greasy appearance which we can remove only after repeated trials. Even then the silver film very often does not stick firmly to the glass in all cases."

A further instance cited, which occurs in certain interference phenomena, is that which can be produced only if the surface of the glass is previously coated with gelatin, which must be allowed to harden, and is then pulled off. This apparently is the only means of obtaining an absolutely clean surface.

It is now desired that some experimenter with the leisure and skill necessary to make a study of this surface phenomena give his undivided attention to this subject, and Mr. Kollmorgen assures us that in his opinion there is no doubt that such an experimenter may reap a rich harvest, and prove an inestimable benefit to the men who go down to the sea in our submarines.

The Southern Canada Power Company continues to extent its system. The company has now acquired the Brome Lake Electric Company, which supplies power to the towns of Waterloo, Knowlton, and Foster, thus bringing up the total of cities and towns supplied with current and light by the Southern Canada Power Company to 35.

T. Pringle & Son, Limited, Montreal, have prepared plans for a small water power at Coaticook, P.Q., for Penmans Limited. It is proposed to erect a power house, construct a concrete dam, and install a 180 h.p. turbine (to replace the existing one), which will be connected with the present generator.

Useful Knowledge Regarding Wounds

Never put a cobweb or chew of tobacco on a wound to stop it from bleeding. This will only infect the wound and will do no good. In case a person is wounded and it is necessary to wash out the wound before a doctor arrives, use a solution of iodine—one tablespoonful in a tumbler of water. You can always get that in most places; but if you can't get iodine, use gasoline, but never kerosene. Lockjaw or tetanus is rare around garages because the men there always have more or less gasoline on their hands.

Nail Punctures.

It is quite often that a fireman will stick a nail in his foot around a burned building. A nail hole in the foot is a common cause of lockjaw or tetanus and should always receive the attention of a good doctor as soon after the accident as possible. A remedy much used for a nail puncture is turpentine. Don't put turpentine on a nail-hole wound. Don't let anyone else put turpentine on a nail-hole wound. Turpentine is a fine remedy for a surface cut, as it quickly heals the wound on the outside. This is just what you don't want in case of a nail puncture. If the outside heals up before the inside does, serious consequences will follow. Send for a doctor at once, and if you can't get a doctor, remember that a nail hole is always infected—from the shoe, if nothing else—and must be sterilized. The wound also has a tendency to close. A fine treatment for a nail hole is laudanum. Laudanum is a solution of opium and alcohol, and the effect on the wound is that it cleans it out and relieves the pain and leaves nature to heal the wound; and nature always starts at the bottom of the hole and heals toward the surface. If you can't get laudanum, use iodine solution. This will not relieve much pain, but will kill every germ.

To be sure that laudanum or iodine goes to the bottom of the hole, apply it in a poultice, and the wound will absorb it.

Don't Give Patient Alcohol.

Never give a wounded person alcohol in any form. You are doing him more harm than good, for when he reaches the hospital he has to overcome the effects of the alcohol and the wound, and it is often the case that he can only overcome the wound.

Entirely British Company

The Sterling Telephone & Electric Company, Limited, announces that the enemy shares of this company have now been acquired from the Public Trustee by Sir John Bethell, Bart., M.P., and his friends. Sir John Bethell has consented to act as chairman of the company. Sir Thomas Bethell (brother of Sir John) and C. S. Syrett, Esq., have also been elected directors of the company. The whole of the shares are now entirely held by British-born subjects. The difficulties associated with the enemy share-holding having been removed, the company trust they may confidently look forward to a continuance of friendly relations and support from their old patrons.

Sales Manager, Electric Alloy Company

Mr. A. W. Hartigan, of the New York sales department of the Western Electric Company, has been appointed sales manager of the Electric Alloy Company, with headquarters at 41 Union Square (Room No. 817), New York, N. Y., where all communications pertaining to sales should be addressed. The Electrical Alloy Company also announce that they now occupy their new, large, modern, fireproof factory building, just completed in Morristown, New Jersey, which will enable them to vastly increase their production

A Contractor's Code of Ethics

You can't repeat a good thing too often—that's why we reproduce the "Code of Ethics" of the National Electrical Contractors' Association below. Read these over again and then say if you think Canadian electrical contractors can do better than adopt—and live up to—the same standards:

Section 1. Members of the association shall regard themselves as being engaged in a business in which there is a well-defined duty and obligation toward the public and themselves. The business demands that members use every honorable means to uphold the dignity and honor of this vocation, to exalt its standards, and to extend its spirit of usefulness.

Section 2. Every member of this association should be mindful of the public welfare, and should participate in those movements for public betterment in which his special training and experience qualify him to act. He should not, even under his client's instruction, engage in or encourage any practices contrary to the rules and regulations safeguarding life and property, for as he is not obliged to accept a given piece of work, he cannot, by urging that he has followed his client's instruction, escape the condemnation attaching to his act. Every member of this association should support all public officials and others who have charge of enforcing safe regulations in the rightful performance of their duty. He should carefully comply with all the laws and regulations touching his vocation, and if any such appear to him unwise or unfair, he should endeavor to have them altered.

Section 3. It is unbusinesslike for a member of this association to assist unqualified persons to evade or to lend himself in the evasion of any of the recognized rules and regulations governing electrical work.

Section 4. Members of this association should expose, without fear or favor, corrupt or dishonest conduct and practices of the members of their business, and it is their duty to bring to the attention of the proper authorities the existence of electrical conditions which are unsafe to life and property.

Section 5. Members of this association owe a duty to the business of refusing to furnish estimates to general contractors who do not regard bids as final and binding upon which they are awarded general contracts.

Section 6. Members of this association shall not falsely or maliciously injure, directly or indirectly, the business reputation, prospects, or business of a fellow-member of this association.

Section 7. Members of this association shall not attempt to supplant a fellow-member after definite steps have been taken toward his employment or toward the letting of a contract to him. Nor should they offer any interference in the carrying out of said contract or commission to the end that loss or damage may result to the fellow-member.

Section 8. Whenever disputes or differences arise between members it should be the duty of the parties to the controversy to submit the trouble to an arbitration of two disinterested members of this association, and in the event of a failure to arrive at a satisfactory settlement, then, upon request, the president of the national association shall appoint a third member of the commission, and the decision of the majority of said commission shall be final and binding.

Vancouver's First Electric Show

The electrical contractors and dealers of British Columbia are evidently determined to make "Vancouver's First Electric Show" something to be looked forward to beforehand and remembered long afterwards. The following item just received will not only make us all more eager than ever to go west this year, but it will fix the date pretty definitely. We wish them every success and a record attendance and sales record.

To Electrical Men Throughout the Dominion

When planning your vacation this year remember the annual convention of the B. C. Association of Electrical Contractors and Dealers—Vancouver's First Electric Show—Vancouver's Exhibition Week—All during the week of August 20th to 25th. Electrical men are invited to get in touch with the secretary at once if they contemplate being on the coast during the week. B. C. Association of Electrical Contractors and Dealers, president, C. H. E. Williams, North-West Trust Building, Vancouver. Secretary, E. Brettell, Electric Supply Company Limited, 581 Granville Street, Vancouver B.C.

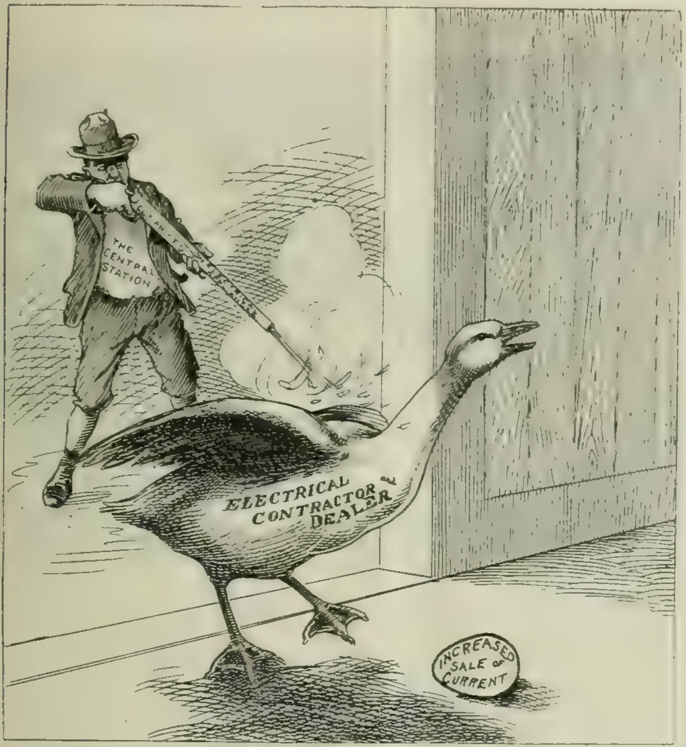
Toronto Electrical Contractors' Dinner

Another of those successful get-together dinners was held on the evening of February 14 by the Electrical Contractors of Toronto, at which Mr. Wills Maclachlan, Inspector of the Electrical Employers' Association, was present, and, after dinner, addressed the members on certain phases of accident prevention. The attendance at these evenings is keeping up splendidly and animated discussions, in which increasing numbers of contractors take part, are a noticeable feature.

In the interval since the last meeting the chairman, Mr. K. A. McIntyre, has been working towards the formation of a definite organization, as it is now felt that the primary object of the movement—getting acquainted with one another—has now been pretty well accomplished. It is expected that the Committee will be prepared to submit a definite scheme at the next dinner—March 7—for the members' consideration. This is a matter in which every electrical contractor in the city is personally interested, and it is urged that "previous" engagements be set aside on that occasion, so that whatever form the organization may take may have the benefit of the fullest discussion,

Don't Shoot the Goose

Everybody has read the story of the goose that laid the golden egg; and to-day it is the electrical contractor and dealer who is closer to the buying public than those in any other branch of the electrical industry The electrical contractor wires the homes and the buildings, and the electrical dealer sells electrical appliances of all kinds, all of which increases the sale of electric current by the central stations. The electrical contractor and dealer creates this business and makes possible a large revenue for central stations from the sale of current. In this respect, is not the contractor likened to the valuable goose that laid the golden egg? Certainly central stations should assist electrical contractors and dealers rather than "kill them off" with the gun, "cut prices on electrical appliances," and "wire your home at cost" arguments. It is a story old, but true.—National Electrical Contractor.



Cleaning Off the Frost

Why are 99 per cent. of the fan motors in the country put away on the shelf the first of September to remain there until the first of May?

Hundreds of storekeepers watch the frost form on their show windows, killing what should be their best advertising asset, when a fan intelligently placed in each window would keep the glass clear.

Tests made in zero weather show that a 12-inch fan will take a heavy frost off a small window in from three to five minutes when the general humidity of the warm air in the room is reasonably low. The warm air blown against the window must first melt the frost and then absorb the moisture on the glass. Stationary air does not do it; moving air will do it quickly and at little trouble.

If the air in a closed-in show window is cold or damp and circulation inside the enclosure will not remove the frost quickly, the fan may be set outside an opening, to blow in warm, dry air from the main store. After the window is clear a small fan in the window, set to blow upward along the glass, will keep the window clean.

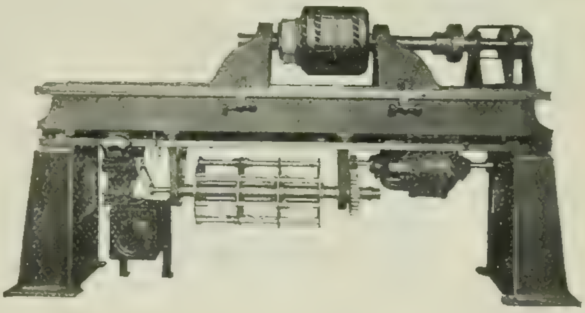
Akimoff Dynamic Balancing Machine

A perfect dynamic (running) balance is something very hard to obtain, though often to be desired, particularly in high-speed machines. The importance of running balance in high-speed machinery is well understood. Rotating machinery cannot run properly unless it is perfectly balanced. Even a small amount of unbalancing will give rise to a host of troubles, such as noise, vibration, excessive power consumption, and undue wear of the bearings. These effects are especially serious in high-speed machinery, as for, instance, automobile crankshafts, motor armatures, and turbine runners.

As a means for determining the amount of unbalance obtaining and correcting it, Mr. N. W. Akimoff, chief engineer of the Dynamic Balancing Machine Company of Philadelphia, Pa., has perfected the machine shown. The machine is driven by a Westinghouse motor, and the picture shows it ready for balancing a motor armature. The balancing of rotating elements of electrical machinery and of automobile shafts have, so far, been two of the most successful applications for which this machine has been used. The principle upon which the machine operates may be described as follows:

An unbalanced condition of a body rotating at a relatively high speed may be due to lack of static balance or lack of dynamic balance. An indication of static unbalance may be obtained with a static balancing machine. Correcting for such unbalance involves drilling one hole or adding one weight to bring the centre of the mass of the body on the axis of rotation. In a statically balanced body, however, two masses on opposite sides of the axis of rotation, located axially at a distance from each other, form on rotation, a couple which develops vibrations, as is noted in defective commutators in electrical machinery, etc. The Akimoff dynamic balancing machine furnishes a means for determining easily and correctly the magniture and plane of the couple, by the establishment of another couple which, while maintaining the static balance, counteracts the couple which produces dynamic unbalance. The magnitude and plane of this couple indicates the correction to be applied to the body under test to produce a perfect dynamic balance.

A rigid horizontal beam, such as a lathe bed is hinged at one end of the machine and supported by a spring at the other. The body to be tested, already in perfect static balance, is rotatively supported on the beam. If dynamically unbalanced the body will, on rotation, cause the beam to vibrate in a vertical plane. The object of the spring is to amplify the vibrations. A so-called squirrel cage is located on the underside of the beam, and, in operation, is rotated in unison with the body being tested. This squirrel cage consists of two circular discs carrying an even number of rods arranged slidably in the two discs and parallel to the axis of rotation of the cages. When the ends of the rods are in one plane the cage is in both static and dynamic balance, but if two opposite rods are displaced the dynamic balance is destroyed and the couple produced will itself cause vibration of the beam. One pair of rods in the squirrel cage would suffice if the relative position of the rods could be altered



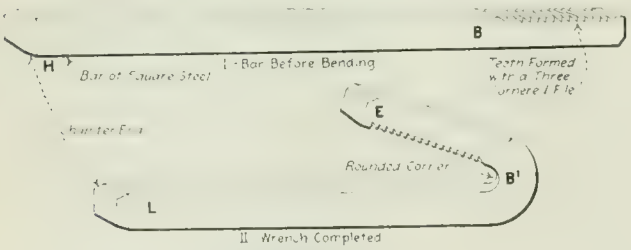
through the transmission device, but, for convenience, three or four pairs are employed, and even then it is sometimes necessary to change the angular position of the cage so that the balancing can be done by one pair of rods and not two.

In making the test of a body the cage is adjusted so that the vibrations produced in the beam by the body are damped out by those set up by the squirrel cage. An arrangement whereby the rods of the cage may be adjusted axially while the cage is in rotation is provided, and by utilizing this arrangement the rods are shifted until the desired effect is produced.

Alligator Type Pipe Wrenches

Answering the question, "Has anyone ever had any success using pipe wrenches of the alligator type?" the National Electrical Contractor prints the following illustrated reply:

Once when we were working out in the country doing a little conduit work we found that we could get along better if we had two more pipe wrenches. We could borrow or purchase none without sending away for them, so we had a blacksmith make two out of pieces of square bar steel, as shown in the figure herewith. These wrenches worked all right for a makeshift In the sketch at the top of the picture marked "I" is shown how the bar of square steel, after it had the teeth filed in it, appeared before it was bent into the completed wrench shown at "II." Of course, before the teeth were filed in the bar it had be annealed. The teeth were cut with a three-cornered file. To bend the bar it was heated until red hot and then it was partially cooled by dipping the end HB into water, the portion with the teeth filed in it from B outward still remaining red hot. Then the portion LB was laid flat on the anvil and the end E hammered around into the position shown. After bending and while the teeth are still annealed, they should be "touched up" with a sharp file. Then the bar is hardened in oil, so that a smooth file will just cut the metal. It should not be too hard or it will be brittle. This kind of a wrench is used in the same way as in an alligator wrench.



Improvised pipe wrench.

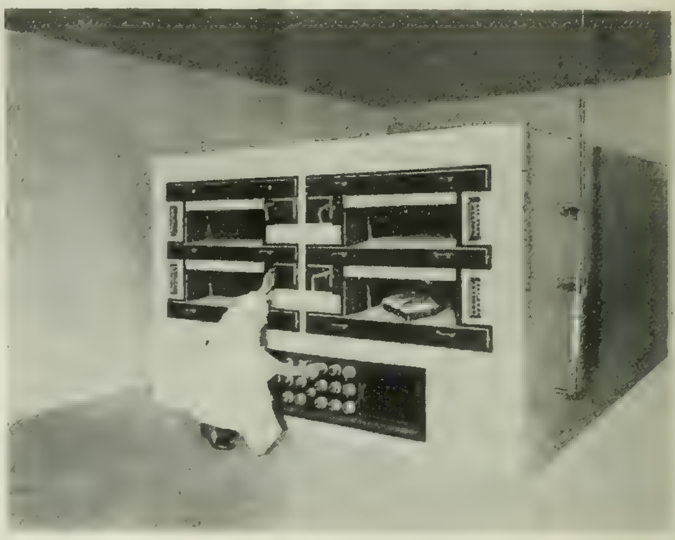
Jovian Bonspiel

Under date of February 10 we received the following item from the secretary of the Winnipeg Jovian League:

The Monster Bonspiel of the Winnipeg Jovian League is under way with seventy-two Jovians playing. This is the third annual Jovian Bonspiel which the Winnipeg League has staged, and is proving a source of great amusement and a splendid way for the boys to get together. The rinks are drawn from the hat, so that only the Goddess Chance has anything to do with grouping the men. The League has commenced its luncheon season once more, and the first event was held January 10th, when Chief Justice Maters spoke to sixty-three members on National Registration and Compulsory Service. On the 24th of January Mr. R. C. Henders, president of the Manitoba Grain Growers' Association, gave a splendid talk on the activities of that body.

Hughes Electric Bake Oven

During the past few months the art of building electric bake ovens has progressed to such an extent that the Hughes Electric Heating Company have developed the new line of brick type construction shown in our illustration. This particular oven has a capacity of 600 one-pound loaves of bread at one baking, though it can, of course, be used for baking 24 or 32 ounce loaves. These ovens are supplied with steam valves to give the necessary gloss to the loaf. They are also equally adapted for pastry baking. Such ovens are not only suitable for large bakeries, but are gradually coming into use in hotels, restaurants and various institutions.



Electric oven Note ease of control.

The ease of control is one of the many satisfactory features about these ovens. Each compartment is independent of the other and is controlled by a separate set of switches placed at the bottom, as shown in the figure. The interiors of the ovens are also equipped with electric lighting, controlled from the same panelboard at the bottom of the oven. Each compartment is also equipped with a thermometer. The doors are of the heavy mechanical balance type. Throughout, this oven is constructed with special care as to heat insulation, so that there, is practically no loss of energy. For this reason the surface capacity of the oven works out at about twice that of the ordinary brick bake oven.

Such an announcement as this is particularly interesting at the present time, in view of the great shortage of coal. Even with coal at $7.50 or $8.00, the cost of electric making has compared very favorably, but now that this price has been increased by approximately 50 per cent., and this added to the uncertainty of supply, the argument has turned decidedly in favor of electric heat, and we have no doubt that the most progressive bakers, and others in a similar position, will look into this matter very carefully within the next few months. Already several large installations have been made at various points in the United States, and also at isolated points in Canada, all of which are giving the most complete satisfaction. In addition to the many other advantages, the cost of operation is working out less than was anticipated.

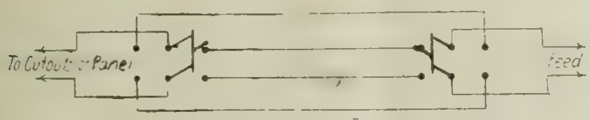
The Hughes Electric Heating Company are at present negotiating for the installation of a number of these ovens in Canada.

At the annual meeting of the Laurentide Power Company, the president, Mr J. E. Aldred, stated that the company were finding a ready market for all the power they were able to produce.

Wiring for Control of Heavy Circuits from Two Locations

The problem occasionally presents itself to the electrician of controlling an important or fairly heavy circuit from two locations. The National Electrical Code does not permit the use of single-pole switches to control a circuit of more than 660 watts, and the Code considers a three-way switch as a single-pole switch. Consequently, many electricians are at a loss as how to wire for this condition properly. The following method, while not new, may therefore be helpful to some.

The accompanying diagram shows how it is possible to control several circuits from two different locations without the use of three-way switches and still have the same control as a set of three-ways, and at the same time comply with the Electrical Code. It consists merely in the use of a pair of double-pole, double-throw switches wired as indicated and installed in approved cabinets.



Controlling a heavy circuit from two points

This system can be used to great advantage in moving-picture theatres to control the house lighting. One switch is installed in the operator's booth and the other down stairs in the manager's office. When the operator is ready to start the show he can throw off the house lighting by pulling out the switch in his booth, and in case of a fire or panic in the theatre or for any other reason the manager can instantly light up the house by throwing in his switch, which will save the time of running up to the booth or calling to the operator to switch on the lights.

Of course, it is understood that the switches must be heavy enough to carry the required load, also that each switch must always be kept closed in one position or the other, never left open.—J. D. Lynett in Electrical Review.

Portable Welder for Rail Bonding

The need for a light portable outfit for electric welding rail bonds to the rails has been uniquely filled in the portable welder recently developed and put on the market by the Electric Railway Improvement Company, Cleveland, Ohio. The outfit consists of an electric furnace, weighing 65 pounds, and a rheostat, weighing 200 pounds. By means of these two pieces of apparatus, current may be taken from the trolley and utilized in welding the copper rail bond to the rail. When the weld is completed the copper of the bond and the steel of the rail are so intimately and firmly united that there is no chance for a depreciation of the electrical contact thus made.

Light, portable outfit for welding

The electric furnace measures about 6 in. x 8 in. x 8 in., and when in operation is supported by means of a yoke resting on the top of the rail. The final adjustment for position is accomplished by means of two hand wheels which give the operator complete control of the position of the furnace. The heat is transmitted to the bond by means of an incandescent piece of graphite pressing against it. One of the popular points in connection with this furnace is the fact that no flame or arc strikes either the bond or the rail. Likewise, there is no arc exposed to the eye, thereby doing away with the blinding effect of intense light.

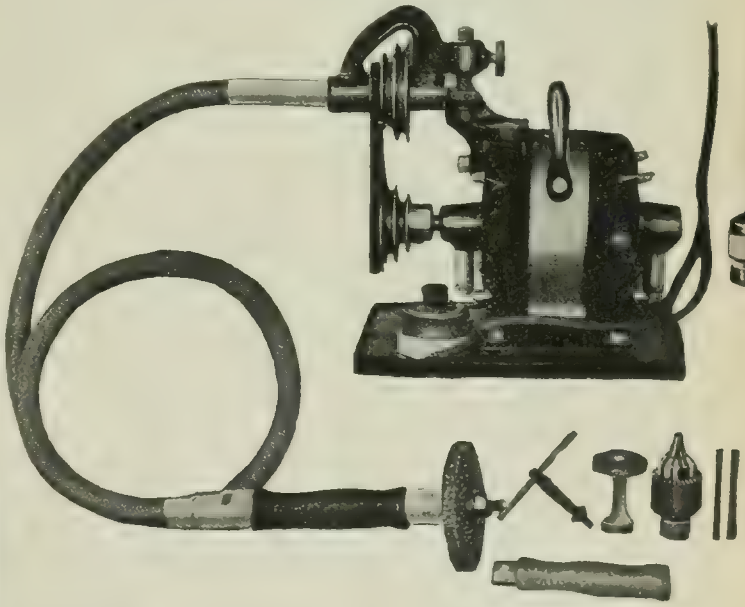
The rheostat measures about 15 in. x 20 in. x 24 in., and is equipped with necessary switches and circuit breaker. By means of it, the electric furnace can be used with a line voltage of anywhere from 150 to 600 volts. It is equipped with handles, making it handy for two men to carry. The furnace may be placed on the top of the rheostat while moving from one rail joint to the next, thus making an easily portable outfit.

The whole outfit may, if desired, be mounted on a four-wheeled lorry for pushing along the track. The power consumption of the welder is claimed to be from 1 to 1½ kw. hours per 4/0 bond.

It is believed by the manufacturers of this outfit that it will put electric welded bonds within the reach of the smaller electric railways, and at the same time will be in certain demand by the larger roads, for use where traffic or other conditions forbid the use of a larger and more complicated apparatus.

Used in Munition Factories

The equipment illustrated is manufactured by the N. A. Strand Company, Chicago, and distributed in Canada by R. E. T. Pringle, Limited. It is a general utility apparatus with flexible shaft as shown and is being used at the present time largely in munition factories for cleaning out the interior of high explosive shells. For this purpose a special set has been developed consisting of grinder, steel brush and cotton buffers. There is also a chuck which can be inserted for the use of steel drills. This equipment is now carried in stock ready for distribution to the Canadian market.



The London Street Railway, London, Ont., have under consideration the purchase of new cars and rebuilding of old ones. They will also be in the market for a $25,000 work car shortly.

Current News and Notes

Brandon, Man.

A movement is on foot to license the electrical contractors of Brandon, Man.

Brantford, Ont.

After apportioning $7,500 for depreciation the Hydro-electric department of Brantford, Ont., were able to show a profit of $8,586 for the past year.

The annual report of the Brantford, Ont., municipal railway for the year 1916 shows a deficit of $1,195. This is due to the fact that $6,000 was set aside for the payment of pavements laid during the private ownership. All operating and fixed charges were met.

Brigden, Ont.

A by-law was recently carried by the ratepayers of Brigden, Ont., authorizing an agreement with the Hydro-electric Commission of Ontario.

Chatham, Ont.

City council is negotiating for $50,000 debenture issue to purchase the electrical business of the Chatham Gas Company, and for an additional $65,000 to provide for changing over the service to Hydro. This will add 1,600 customers to the local Hydro system, which is now serving 1,500.

Edmonton, Alta.

The city council of Edmonton, Alta., have under consideration extensions to the light and telephone systems at a cost of $2,000.

Hamilton, Ont.

The city council of Hamilton, Ont., are considering the installation of a police signal system; estimated cost, $10,000.

Kilsyth, Ont.

The council of Derby Township, Kilsyth, Ontario, are contemplating the installation of a new electric lighting system—work to start in the spring.

London, Ont.

The Northern Electric Company have leased premises at 362 Richmond Street, London, which will be remodelled and fitted up as a high-class electric store and warehouse.

The London, Ont., public utilities commission plan to extend the local hydro system at a cost of $50,000. Wire and general equipment will be required.

Montreal, Que.

The Southern Canada Power Company, Montreal, Que., in extending its system throughout the province of Quebec, have taken over the Brome Lake Electric Company, supplying the towns of Waterloo, Knowlton and Foster. The Southern Canada Company is now supplying light and power to 35 cities and towns in the province of Quebec.

New Westminster, B.C.

With the object of popularizing the use of electricity for domestic purposes, Ald. Goulet, chairman of the electric light committee, New Westminster, B.C., is working to have the present rate of 5 cents per kw. hour net reduced 4 cents with a 20 per cent. discount for prompt payment.

Paris, Ont.

The Paris, Ont., Hydro-electric System, which had a deficit of $210 in 1914 and a surplus of $632 in 1915, closed the year 1916 with a surplus of $1,687.

Preston, Ont.

The ratepayers of Preston, Ont., will vote on a by-law on March 5, authorizing a loan of $75,000 to the Preston Car and Coach Company for rebuilding their car shops, recently destroyed by fire.

Sarnia, Ont.

Hydro-electric service in Sarnia, Ont., has been interrupted several times lately. It is also stated that the city is losing about $1,000 a year through its contract to supply power to the Sarnia Street Railway. This contract is valid for the next five years.

Scarboro, Ont.

The Scarboro Council recently passed a by-law authorizing the issuing of debentures for $18,500 in connection with the installation of Hydro-electric power in the township.

St. Catharines, Ont.

The building occupied by Muller and Flower, electricians, St. Catharines, Ont., was destroyed by fire recently.

St. Thomas, Ont.

The St. Thomas Hydro-electric Commission announce a surplus of $13,458 for the year 1916.

Tillsonburg, Ont.

The Canadian Cereal Company, Tillsonburg, Ont., are planning to install complete new electrical equipment to operate mills.

Toronto, Ont.

The Toronto Hydro-electric Commission, 15 Wilton Avenue, Toronto, will receive tenders for synchronous condensers until March 28.

Verdun, Que.

The city council of Verdun, Que., have authorized plans and specifications for underground conduits at a cost of $200,000.

Walkerville, Ont.

The annual report of the Walkerville Hydro-electric Commission shows that the local system made a profit of $12,000 during the last year.

Wiarton, Ont.

The town council at Wiarton, Ont., are negotiating with the Hydro-electric Power Commission of Ontario for a supply of electric current.

Windsor, Ont.

The Canadian Steel Corporation, Windsor, Ont., are negotiating with the Ontario Hydro-electric Commission for a power supply. If, as is anticipated, a contract is closed for 2,000 h.p., the local rate for Windsor users will likely be reduced. This city at present uses 800 h.p

Wingham, Ont.

The town council of Wingham, Ont., are negotiating with the Hydro-electric Power Commission of Ontario for a supply of power.

Winnipeg, Man.

City council of Winnipeg contemplate enlarging power plant to 100,000 h.p. in the near future. Estimated cost of work $150,000. The plant at present consists of eight generators, seven of which are in use. These develop 42,000 h.p., which is anticipated will take care of requirements until 1918. The proposed expenditure will place the eighth unit in operation, giving a total of 50,000 h.p., as well as providing for further additions as required.

Wolseley, Sask.

The town council of Wolseley, Sask., are planning extensions to the local light and power plant at a cost of $9,000.

Electrical News

Generation, Transmission and Application of Electricity

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The Organization of Canada's Technical Men

There is one big question before all Canadian engineers and technical men to-day—organization. We believe this fact is generally recognized and admitted.

Perhaps no more definite proof of the unsettled condition of engineers' minds can be found anywhere than in the changes that are now taking place both in sentiment and personnel in the Canadian Society of Civil Engineers. It is felt by a large percentage of the members of this society that their name is a misnomer—either the name must be broadened to correspond more nearly with the avowed scope of the society, or the scope must be narrowed. This matter is now under discussion practically all over the Dominion, and the very fact that this discussion is long drawn out is perhaps the best proof that the solution is not easy.

It is generally understood that primarily the Canadian Society of Civil Engineers was intended to include all types of engineers. However, in those days, electrical, mechanical, chemical and mining engineering were merely in their infancy, and, this being the case, the management of the parent society naturally devolved upon the civil engineers proper, who, as a profession, were fairly well developed and organized. The infants grew up, however, as infants will, but, as often happens in domestic life, the parent continued to think of them still as children and failed to give them a proper voice in the management of the business; failed to take them into partnership. The inevitable result followed—the young ones left home and started up in business for themselves.

So to-day we have in Canada, in addition to the parent society, a number of more specialized organizations—the Canadian Mining Institute, the Chemical Society of Canada, branches of the American Societies of Mechanical and Electrical Engineers, all more or less technical and eligible, for the most part, for membership in the parent society but divorced from it largely through lack of parental sympathy and recognition.

And now, at the eleventh hour, the parent seems inclined to admit that he has been a little arbitrary, perhaps, with his offspring, and appears ready to make overtures. It is not evident, yet, what the result can be. The younger societies are well established and growing rapidly. They have reached a position of independence where they can arbitrate. It is not, however, any feeling of independence or resentment that causes them to consider, very carefully, any movement back into the old organization. The fact is, their aims are different. It is as if the son of a manufacturer of machinery withdrew, for some reason, from his father's business and started up in the business of manufacturing shoes, for instance. There could never be any inducement for this father and son to combine their businesses for the reason that they are so entirely different, do not dovetail in any way, and this is the attitude, in a sense, of many members of the younger Canadian societies, when the question of going back into the parent organization is broached.

* * *

There seem to be at least two general courses that may well receive consideration at the present moment. The first is the change of the name of the C. S. C. E. by dropping the word "civil" and so changing the constitution that there could be included, within one big organization, civil, electrical, mechanical, mining and chemical sections on an absolutely equal basis. That would presuppose, of course, the acceptance into membership in the new society of all the members of the various sections, and many of these members are not technical men in the sense in which this term is usually accepted. Would it be possible, or, if possible, would it be desirable, to so constitute any one organization that it would be acceptable to so many varied interests?

The other suggestion is based on the realization that technically trained men have, to-day, a double interest in life, the first—professional—the second—national. For strictly professional purposes classification into smaller units seems to be the most useful and effective. For national aims the organization may well include not only engineers and technical men, but all men whose interests or instincts or training bring them into intimate contact and sympathy with technical men and whose ideals would be, in general, the same. This suggestion, then, leads along another line of thought—that the present societies retain their identity and independence in all matters pertaining to their own particular professional work, and that a general organization, including the members of all the independent societies, and governed by a central body including representatives from all the independent societies, be formed for national work in which all are equally interested.

It is safe to say, we believe, that this matter is receiving the careful thought of the majority of our various societies to-day, and that they are considering it with an open mind. A conclusion reached on this basis will bring unity of action. And united action among engineers and technical men generally could solve for us many of the national problems which clog our progress while we, as yet, sit hopeless and helpless.

Montreal Electrical Luncheon Club

A paper on "Electric Light and Power Problems at Steam Railway Terminals" was read by Mr. J. W. Hughes, electrical engineer, eastern division C. P. R., at the Montreal electrical luncheon on February 28. Mr. Hughes referred in detail to the problems of an electrical nature arising from the introduction of methods for reducing operating costs of steam and electric plants used at terminal points on steam railroads. He also stated that the improvements were mainly obtained by the replacement of steam-driven apparatus by electric motor drive. The use of electric baggage and freight trucks had proved economical and advantageous. Great developments had taken place in the employment of electricity for electric welding, cutting and patching, and for electric clocks, train despatching, elevators, vacuum cleaners, grills, and typewriters. The last section of the paper dealt with lighting problems, particularly in roundhouse and freight and passenger yards. Replying to Mr. Hyde, who proposed a vote of thanks, Mr. Hughes said that as to the use of batteries in electric trucks, efficiency was largely a matter of temperature, and the most important point was to obtain batteries which would stand up to the rough use received by the trucks.

Apportioning Cost of Montreal Conduits

Some time ago the Electrical Commission of Montreal brought in a report distributing the assessment of the cost of operation of the underground conduits against the various companies concerned. The Quebec Public Utilities Commission took exception to this report, claiming that the basis on which these computations were made was not right, inasmuch as it concerned merely the space occupied, or reserved, by the various companies, and did not take into consideration certain extra spaces constructed by the city in anticipation of future development. The Quebec Public Utilities Commission, therefore, decided that the matter should be referred back to the Electrical Commission for a revision of assessments, these to be fixed in such a way that all the users of the system should bear their proportion of the cost of the entire system. The Court of Appeals, to which the matter was referred by the companies, has now rendered judgment confirming the decision of the Quebec Public Utilities Commission.

Electric Trucks Master Blizzard

New York City, on February 5th, 1917, experienced a very severe blizzard. A fifty-mile gale accompanied the heavy snowfall, and traffic was badly affected throughout the city. The poor horse was literally "snowed under." The American Express Company, which operates 245 electric trucks and 259 gasoline trucks in the city, on this stormy day had forty-six trouble calls from their motor trucks. Six of these calls were from "electrics," and forty were from disabled gasoline trucks. It was necessary to tow in two of the electric trucks, and fourteen of the gas cars. This creditable showing of the "electric" is only one of the good reasons why express companies are using electric trucks in large quantities. The almost absolute dependability of the electric truck puts it foremost in the handling of express, as well as in many other businesses requiring dependable transportation facilities. Comparative operating costs have proven the economy and efficiency of the "electric" in delivery work, and these are as great assets as its dependability. The electric commercial vehicle has made rapid strides during the last few years, and is becoming more and more a factor in city transportation.

Cedars Rapids Extensions

Plans have been prepared for the installation of additional units at the Cedars Rapids plant of the Civic Investment and Industrial Company, which is later to be officially known as the Montreal Light, Heat and Power Consolidation. The present generating plant consists of ten 10,000 kv.a., 6600 volt, 3 phase, 60 cycle, vertical water-driven units with 1250 kv.a., 2300 volt, 3 phase, vertical exciter units. The demand for power continues to be very active, and the erection of, and addition to, other munition factories will increase this demand. The two new units will be 10,000 kv.a. capacity each, and the contracts for the turbines have been let to the I. P. Morris Company. The entire substructure work will be carried out by Fraser, Brace & Company.

Personal Mention

Mr. M. Leighton Wade, for the past two years electrical superintendent at Duncan, B.C., has resigned, and will reenter the plant construction field. Mr. Wade received his training at McGill, and is an experienced construction engineer in hydraulic, electrical and Diesel engine work.

Mr. R. H. Starr has severed his connections with the engineering staff of the Toronto Hydro Electric System, and has accepted a position as sales engineer with the Toronto sales office of the Moloney Electric Company of Canada, Ltd.

Mr. Fraser S. Keith, editor of "Construction," has been appointed secretary of the Canadian Society of Civil Engineers, following the resignation of Professor C. H. McLeod.

Mr. Fraser S. Keith.

Mr. Keith is a graduate of the Faculty of Applied Science of McGill University (1903) and has since had a varied experience that will make for greater efficiency in his new position. For a time he was demonstrator in electrical engineering in his alma mater and later became engaged in technical editorial work. Between times he has spent several years in the west in the manufacturing of concrete materials and in concrete construction work.

The city council of Kitchener, Ont., have decided to cut down the street lighting by 400 lamps, which will effect a saving of $2,000 a year.

The Art of Efficient Train Lighting

Rapid Progress in Recent Years—The Unit Method Most Popular—The Function of the Storage Battery and Description of the Various Types Used—Generator Regulation a Difficult Problem

By A. C. Turtle*

The most popular method of lighting passenger equipment today is the unit method, in which each coach is equipped with its own generator, storage system, and automatic switchboard. This method is most easily adapted for general service conditions under which the average railroad operates. It admits of flexible operation, in this, that trains can be run en-bloc, and at the same time coaches can be detached for branch service, and be also run independently on any railroad without interference with the lighting equipment. Where the head end system is used this flexibility is abandoned, owing to the necessity of having a dynamo car on all trains on which these cars are liable to be used. As very few railroads are using this system the drawback on interchanging is easily seen, especially when the head end system is run at 60 volts, and the unit system is run at 30 volts. I should mention here that this method is only in use at the present time to the extent of two per cent. of the systems in use.

A stand-by battery is usually installed with all forms of car lighting, including the head end system. These are kept in charged condition by means of the generator unit that is part of the equipment. In the head end system there are practically three different methods in use of applying this apparatus.

The first has the lamp load between one negative and the common positive line, and the batteries between the other negative line and the common positive. The two negatives and one common positive compose the train line which runs throughout the train. Rheostats, of which a unit is usually allowed, for every car, are placed in the dynamo car to control the voltage of the lamp load. This allows the generator voltage to be brought to 80 volts or so when charging the battery line, on the 60 volt system without disturbing the lamp voltage.

The second method is an arrangement which provides for the splitting up of the batteries into two halves, and charging them in parallel across the train line with adjusting resistances varying the charging current as would be found necessary. The adjusting resistances are usually separate on each battery equipped car, instead of as in the previous case being in the dynamo car. The batteries are charged at midnight when the lamp load is mostly off.

In the third system a lamp regulator is applied to each car, which will take care of 30 per cent. rise in voltage, thus enabling the batteries to be kept in constant full charge while the train is in service. The battery, of course, is in series, and owing to the lamp regulator system can be charged at any period of the night, such as at the terminals or stations where steam can be spared from the engine.

The Axle Lighted System

In going back to the axle lighted system, which is in universal use, we are to consider three vital necessities in the design of such, first, the lamp regulation; secondly, the battery, its type, capacity, etc., and thirdly, the dynamo and its essential regulation and polarity. I will now take up these items separately and mention the difficulties to be overcome.

The lamp regulation on axle lighted equipment is a difficult and important proposition. For instance, the relation of constant voltage to cost and service is embodied in the following:—With a delivered voltage three per cent. below the rated voltage of the lamps the available candlepower of the lamps drops ten per cent. If the voltage drops five per cent. the candlepower drops eighteen per cent. The relation of cost comes in the fact that when the voltage on the lamps is three per cent. above normal the life of the lamp is reduced 33 per cent., and if the voltage is 5 per cent. above normal the life is reduced approximately 50 per cent. It is subject to difficulties in operation that the central station does not experience. The central station usually has only one factor deterrent to even voltage, and that would be changing load, other irregularities, such as the power factor, voltage drop, etc., being chiefly a matter of design. The changing load is taken care of by attendants, automatic regulators, and additional power that can be thrown in when the changes in load occur. All this, of course, occurs at known intervals.

With axle lighted cars the load is liable to change at any time as circuits are switched on and off indiscriminately by the porters in charge. The speed of a dynamo is liable to change according to the speed of the train, which may be anything between 15 and 90 miles per hour, and it is also subject to stopping and starting every fifteen or twenty minutes. In addition to this the condition of charge of the batteries may mean charging rate of from nil to fifty amperes from the dynamo, which also has a regulation disturbing effect. In the consideration of the size of this equipment, and the amount of running attention it receives, it is very evident that some unique method of regulating is necessary. On most of the American systems the lamp regulation is taken care of by a separate automatic device. This may be a voltage solenoid acting through a system of levers on a group of carbon plates in series with the main lamp circuit. This is now one of the most popular methods. In some cases it is a device known as the Kennedy regulator, which is made up of constant speed motor, which when certain voltage and current solenoid operate, it in turn, actuates through an arrangement of clutches and springs, two rheostats, one of which regulates the dynamo field, and the other the lamp circuit. Other systems use a regulating battery, on a double battery system, for operating the lamps, and in other cases, resistances are used in conjunction with automatic switches controlled either by governor actuated mechanical gear, or by voltage and solenoid relays, etc.

The Battery

The battery capacity is also an important consideration and is governed by the number of lamps and other current consuming apparatus in the car, by the system to be used, and the kind of service to which these cars are to be put. It may be anything from 200 to 1,000 ampere hour capacity, in conjunction with the above requirements, and it is essentially the heart of the system.

I will now go into the different types of cells used. The Plante or plain ribbed pure lead plate, the Faure pasted type, and the semi-Plante, which is a combination of the above two types, as the name implies, and also the Edison nickel iron cells, all of which are in general use for purposes of storage on train lighting equipments.

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* Electrical Engineer, Grand Trunk Pacific, before Manitoba Branch C.S.C.E.

A brief description of the composition and manufacture of these types will be in line in order to compare the different merits of each. I will start with the Plante plate type.

The Plante Cell

The positive element of this cell is made up of pure lead, which, in order to provide the necessary surface capacity, is ribbed by means of a machine made up of steel discs, which revolves over the pure lead under pressure. This action raises ribs in the lead about 25 to the inch. After this the plates are joined together by means of a bridge, and a connector lug is finally burned on. The necessary number of plates to be assembled is governed by the capacity of the cells for which they are to be used.

The negative elements, up to this point, follow the same manufacture, and an additional plate is always allowed to the negative element, thus allowing for the shrinkage of capacity inherent to the negative element, after it has been in service a while. The assembled plates or elements are treated in an electrolytic bath, which, on the positive plate, produces the lead peroxide, and in the negative plate produces a spongy formation of lead. I note that up to the present, while many interesting theories of the chemical analysis of this spongy lead formation have been advanced, it has not been definitely settled as to its composition. When the two elements are complete they are assembled with hard rubber separators, also side and end sheets, to keep them from direct contact with each other and the box lining. They are then inserted in the containing box in which the porcelain or wood cradle has previously been placed. This cradle serves to keep the element busses clear of the opposite plate top, and also to allow the sediment to accumulate at the bottom of the cell without shorting the elements together. The electrolyte, consisting of diluted sulphuric acid, of the correct analysis, is then added, after which the final period of charging is completed. They are then ready for service.

The Faure or Pasted Plates

With Faure or pasted plates the positives are built up with animonious lead grids of various styles and construction. A great many claims of superiority are made by different manufacturers in connection with the various forms of these grids, and some are decidedly meritorious. A paste of oxide of lead, PbO is made up with a binder and pasted into the grids, and the whole is then placed under pressure until the paste is hard and dry. In doing this the plates are set in tiers with heavy blotting paper or thick flannel placed between them. The negative paste is oxide of lead, Pb_3O_4, before the electrolyte and charging has been added and completed. European practice is to make the positive plate in Plante form, and the negative in Faure or pasted form.

There is one point that I might mention, and it is the practice of some railroads of only putting side rubber sheets and not end sheets between the box linings and the elements. This leaves the end and negative plates in direct contact with the lead lining, which in turn causes the lining to become part of the negative element. This would explain the number of leaking cells where such a method was used as the constant chemical action would tend to make the lead lining porous and spongy.

These troubles are further augmented by grounds in which the current, making circuit through the lead lining, boxes and outside framing, produces the same effect on the lining of the cells.

Frequent inspection and testing is the best safeguard against such troubles.

The Semi-Plante is a combination of the two types in which the negative element is in pasted form, and the positive element is of a base made up similar to the Plante plate, but with the ribbed portions having the ribs of about five to the inch. These ribs are pasted with oxide of lead in the usual way. It is claimed that the base takes the place of the paste lost in the form of sediment during the life of the cell. The positive plate then becomes of Plante form, although of much less capacity.

The Edison

Lastly, the Edison cell, which is of a very distinct design. The negative element is of flake iron or iron oxide, contained in rectangular pockets of perforated nickel steel, fitted into a nickel steel grid. The manufacture of the positive plate is very interesting, and worth mentioning here. The flake nickel that is in the tubes is formed by plating alternately thin sheets of copper and nickel together until a composite sheet of about 1/100" is formed, consisting of 250 layers of nickel and copper alternately deposited. A machine cuts this sheet into 1/16" squares. The copper is then dissolved from the squares in a bath which leaves the nickel flakes intact. This mass of nickel is given a finishing bath in order to remove all traces of the solution and copper. It then has the appearance of a pile of clean snow. The nickel hydrate and nickel flake is then assembled in layers inside the peroforated tubes, one tube usually containing around three hundred layers of each. The flake nickel in this case acts as a conductor between the nickel hydrate and the grids, and therefore is laid in very regular layers. The tubes are reinforced with seamless bands at intervals, which prevent excessive expansion of the active material or nickle hydrate which would have a tendency otherwise to loosen its electrical contact. The electrolye is 21 per cent. of caustic potash solution, with a small amount of lithium hydroxide added.

Battery Characteristics

The characteristics of the different types of cells are worth comparing; in fact, it is with that idea in view that I have mentioned these constructional details.

We all know that the storage of electricity is only the development of an unbalanced chemical state, which, in its reversion back to normal, produces energy in a certain ratio to the amount of energy consumed in bringing about this state; therefore, the ideal method of doing this would be embodied in the Edison cell, in which the active elements are contained in such a way as to allow for expansion and contraction in charging and discharging, and also allows the interdeposition of the active materials to go on undisturbed by a loss of capacity due to settlement of active material at the bottom of the cells, a fault very much in evidence in lead cells.

The composition of lead cells; that is, oxide of lead, active material, antimony or pure lead, frame, and sulphuric acid electrolyte, are such that no satisfactory construction has been found available for the active materials, and in default of this, the active materials have been made up in blocks or buttons, and pressed between different types of grid construction. In some cases the active materials have simply been pasted on a corrugated frame, as in the semi-Plante. As the active materials have expanded or contracted, surface contact on the grids or frames has been interfered with, and by this constant motion loosened those active materials, thus resulting in an extra large amount of sediment or mud at the base of the cell boxes than should be. We should note that the mud cellar or cradle of the Edison cell is only one-third the height of the cradle used in typical lead cells. This is, therefore, a point of superiority on the part of Edison cells, and also a reason for the long life of these cells, which, in tests shown by the manufacturers, have given a life of 1,100 complete cycles, and still show a capacity of 10 per cent. above normal rating. With lead cells the capacity would have decreased possibly 30 per cent. In short, the absence of active material deposit in the base of Edison cells as against the large amount that collects in the base of lead cells is really the chief advantage gained in the use of Edison cells.

One of the chief American concerns manufacturing lead cells have evidently realized this, and have therefore increased the depth of the cradle used in their lead cells, thus prolonging the time or service obtained from the cells between overhauling; in other words, increasing this service from nine months to two years.

The inefficiency of Edison cells would not be of much account in train lighting, though a serious proposition where a charging current was purchased. They are more rugged, and will stand discharge without ill effects, also excessive overcharge rates, providing that excessive temperatures are avoided. However, if we required an especially heavy discharge rate the notable light weight would disappear on account of the low discharge voltage of the cells as compared to the discharge voltages on lead cells.

In summing up it is questionable as to whether the value of the Edison cells is, as some authorities quote, superior for train lighting, by reason of the foregoing; also because the price of Edison cells is almost double that of lead cells for the same capacity. They are not well adapted for high rates of discharge unless the change in voltage is of no account, and are not capable of retaining their charged condition for long periods owing to their constant gassing and internal action. It has been quoted that Edison cells do not need the care that lead cells require. This is true to a certain extent, as far as the bi-yearly washing and overhauling and the repairing is concerned, but not as far as the general maintenance is concerned. The maintenance of the Edison cells requires distilled water to be added every trip owing to the constant gassing and internal action and the electrolyte must be changed every six months, on account of the evaporation and the carbon dioxide absorbing powers of the electrolyte, which would otherwise reduce the capacity of the plates temporarily, and permanently if not watched.

On our own system the voltage of the lamps is dependent to a certain extent on the voltage of the cells. Edison cells result in a large variation of the brilliancy of the lighting. For instance, on one 30 volt car under test I got a reading of 37 volts with only the kitchen circuits in use, with the cells fully charged. It is interesting to note with the above, that on the full five-hour discharge rate on this car the voltages would vary from 28 to 35.75 volts.

The Dynamo and Its Regulation

The third point to be emphasized is the dynamo and its regulation and polarity. The dynamos in car lighting are in a most hazardous position and exposed to attack by the elements, dust, water, snow, ice and flying debris of the road bed, while the mechanical shock and vibration is excessive beyond anything to which a stationery generator is subjected. To cope successfully with these adverse conditions the dynamo must be proof against all of these disturbing and destructive factors, and in order to render it capable of operating equally well, no matter which direction, requires a special design and construction, and imposes upon the engineer a mechanical as well as electrical problem. Very few, outside of the profession, understand what is involved in this, and I believe that axle generators are more carefully designed and perfected than most classes of generating machinery.

Two general methods of supporting the dynamo are in use, and these, to a certain extent, were suited to the type of coaches and service on which they were first used, and therefore have been adapted to the present type of equipment.

The Body-Hung Generator

The body-hung generator idea originated in England with the Stone system, and was adapted to equipment of that date on which the wheel truck or bogies were solid with the car body, and therefore the shaft of dynamo was always in line with the axle of the wheels on which the driving pulley was fastened. This method is still being adhered to, even with the use of six-wheeled trucks on long base cars, and has successfully competed with other methods of hanging; in fact, most of the American systems are now adopting it.

The Truck-Hung Generator

The truck-hung generator is practically of American origin. In this we have a direct and unchanging drive, no matter what curve the car may be travelling on; nevertheless, while it would appear to be the better method of the two, it is becoming a question of dissension among our lighting engineers. Advantages claimed for the body-hung machine are that it saves sixty per cent. of the weight and rigging, etc., over a truck-suspended dynamo. The truck is eased of 1200 per cent. of overbalancing weight. There is more clearance between truck sills and brake beams for the belt. The generator is higher up from the track sills, and it is easier to install or change.

Statistical data, so far, is not reliable enough to form any accurate idea as to the permanent advantage of either, as, at present, the chief body suspended type is made by the Stone Company, and they use a slipping belt method of regulation, which, of course, is different to any other method, although belt mileages compare very favorably with other types, being nearly double the averages taken from 28 different railways.

Regulation

The dynamo current regulation of these different systems is controlled in various ways. The slipping belt has the dynamo hung on a fulcrum pin, with its weight distributed between this pin and the belt. This system is in use to a great extent in Europe, India, Australia, and Canada, and is the pioneer of electric train lighting systems; in fact, was tried out in September of 1895 on the Great Northern Railway in Ireland. This system resolves itself into a constant torque system, and not merely into a constant current system, as nearly all other types do. By this I mean, that the current output would be constant only within certain limits, (as the battery charging rate would be high within those limits, were the battery almost completely discharged, and low,) if the battery were fully charged. This, of course, is a very favorable advantage. We should note that the dynamo begins to slip at a certain predetermined speed and does not increase its speed above that, no matter what the train speed may be.

In other cases the dynamo regulation is effected by an arrangement of governor gears, which force the dynamo armature out of the magnetic field as the speed of the machine increases.

Again, in other forms, it is taken care of by using a differential field winding on the dynamo, in conjunction with the shunt field resistance, which is adjusted by the governor gear on the dynamo.

A very popular method is to control the dynamo current by using a system of carbon plates in series with the field, which varies in resistance according to the contact pressure on them. This pressure is provided by means of current and voltage solenoids, which operate cores of iron connected through a system of levers to the carbon plates. The current cell adjusts the field rheostat, which is on bodied in the carbon plates so that constant current is delivered until the batteries are fully charged. Then the voltage coil still further reduces the pressure on the carbon plates which in turn weakens the field, reducing the charging voltage enough so that the batteries are floating on the generator circuit. This movement is given the necessary retardation by means of air dashpots, located on the panel. This method is used by the Safety Car Heating & Lighting Co., the United States Lighting Co., and the Consolidated Lighting & Heating Co.

The Mather & Platt Method

Another method of which mention should be made is seen in the Mather & Platt system, which requires a rather drawn out explanation. This dynamo, the principle of which is the invention of Dr. Rosenberg, was used extensively in Germany, but has since given place to a certain extent to the Dick system, and also to a certain extent in America, in a modified form, which is put up by the Electric Storage Battery Co. The field is shunt wound and of few ampere turns. The armature is drum wound. The two brushes that would carry the current in a typical armature are short circuited, while another pair at right angles to the short circuited brushes carry the load. The short circuited armature conductors revolving in the shunt field produce a secondary field at right angles to the shunt field. This secondary field circulates through the tips of pole pieces and through the armature. The brushes carrying the load, therefore, obtain their current from the conductors passing through this secondary field, and these conductors in turn produce a flux exactly in opposition to the primary shunt field flux. This opposing flux we will call the load flux in order to make the explanation simpler. The primary or shunt field ampere turns are 10 per cent. more numerous than the secondary flux producing ampere turns on the armature; therefore, the dynamo could not deliver more than a certain current, whether running at high speed or supplying nearly discharged batteries, because the load flux would always oppose the primary flux in proportion to its current. In actual tests very little change in the voltage is experienced from 21 to 65 miles per hour.

The Rosenberg generator used in the Electric Storage Battery Company's system has been slightly re-designed and equipped with a compound field winding. In this case constant voltage of constant current is the objective.

The Polarity of the Dynamo

The polarity of the dynamo is the next important question, and is subject to the polarity of the cells, and also to direction of the train; that is, the polarity must be the same at the battery terminals, no matter the direction of rotation of the dynamo. In some cases this is effected by a switch on the governor gear, which automatically polarizes the field, so that the resultant armature current will be in correct relation to the cells when the dynamo cuts in. I should also mention that in almost all systems the dynamo cuts in the circuit when its e.m.f., or voltage value is equal to the fully charged value of the voltage of the storage cells. Another method is to have the commutator brushes placed on a rocker arm in special ball bearings, so that the friction between the commutator and the brush mechanism is sufficient to move the positive brushes from the positive position of the dynamo going one way, to the stops on the positive position of the brushes going the other way, and, therefore, only the dynamo itself changes its polarity. In the Rosenberg dynamo the polarity at the brush terminals is constant no matter which direction the armature might be rotating.

The cost of installing gas or electric lighting varies considerably, according to the system used, but generally speaking, an electrical installation costs from 50 to 150 per cent. more than a gas installation, i.e., taking the installation of each as being of equal candle power, etc. However, the advantage of electrical application of coach lighting is certainly superior in this, the lighting units can be applied to better advantage, such as the upper and lower berth lights, reading lights, etc., and, owing to the better application, lack of shadows is apparent. Fans can be installed for cooling the air in summer, and, on some of our more up-to-date equipment, curling and smoothing irons have been applied. Heat, smoke and dirt are avoided by such an installation, and the light is instant control for tunnels and terminals. Where gas has been abolished altogether the electric installation has become a safety factor against fire.

The operation of electrical equipment of the various systems requires first class labor, and the better the technical education of the men employed on this work, the more efficient will be the system.

General troubles consist of burnt-off lamps, dead, shorted or reversed cells, bad contacts of switches, cell lugs, resistances, blown fuses, and belt and axle pulley troubles, which are last but not least. I should also mention that, while the body-hung dynamo would, seemingly, from a mechanical point of view, give more trouble with the belts than would a truck-hung system, it is not the case, and, as I mentioned before, it is becoming quite a debatable subject. For instance, the body-hung dynamo allows of a longer belt, the distance between the driving and driven pulleys being between seven and eight feet. The arc of contact is also increased. This, then, seems to be the real point of superiority over the truck-hung dynamo with its consequent short drive of five feet which would allow a certain bowing effect of the belt, and therefore inefficient transmission of power, especially at high speeds. Further, in reference to belt troubles experienced, belt wear and belt losses have engaged the very close attention of engineers. With the former the factor is the quality of belting used, that most suitable being found through tests, which should cover winter and summer operation. For belt losses, the factor, seemingly, is dependent on the pulley flanges, and the alignment of dynamos and axle pulleys with each other. The correct fitting of axle pulley to axle, which, by the way, is only a rough turned forging, (unless the railway especially turns the surface up on a lathe, which is not general practice as yet), correct joining of belt ends, absence of sills and brake beams on which the belt would possibly rub, and the type of belt fastener used. In reference to fitting of pulleys on axles, in some cases the axles are turned, and a correct fit made, in other cases corrugated bushings are used, which align themselves automatically to the rough axle.

Railway companies are now building steel trucks, in which the outside sills and brake beams are done away with, thus allowing full clearance for the belt.

Belt Fasteners

The type of belt fastener used is important. Some fasteners weaken the belts by rivetting, and, owing to their rigidity, cause the belt to break at this weakened point. One type, namely the Walker fastener, is very applicable for use on small diameter pulleys, and also where the belt is allowed a certain amount of slipping as no metal part of the fastener is exposed.

Belt mileages on different railroads vary very widely according to conditions of operating. An average, taken from twenty-five different railways, is given at 28,000 miles per belt, and these different mileages vary from 8,000 to 80,000 miles per belt. These figures show the wide difference in operating conditions that this type of equipment comes up against.

The Water Powers of Western Canada

Comprehensive Data on the Hydraulic Resources of Manitoba, Saskatchewan and Alberta Compiled by the Commission of Conservation—This Article, the First of a Series of Three, Deals Only with the Winnipeg River

The Dominion Government controls the water resources of the Prairie Provinces, and, during the past three or four years, has been particularly active in investigating them. The Water Power Branch of the Department of the Interior administers the water-powers which come under the jurisdiction of the Dominion Government, and has not confined itself to the regulation and supervision of proposed developments. In the territory under its jurisdiction it has sent out field parties to investigate many of the water-powers and to establish numerous gauging stations, where regular observations are taken. This branch has been in active operation since 1908, and, during the past three years, has covered most of the rivers in the southern portion of these provinces. Particular attention was paid to the Winnipeg River, in eastern Manitoba, and to the Bow River and adjacent basins on the Rocky Mountain slope. Reports on these two districts have been prepared, under the supervision of Mr. J. B. Challies, Superintendent of the Dominion Water Power Branch.

Southern Portion More Fully Investigated

The southern or more settled portion of the Prairie Provinces is fairly well covered by the work of these two branches of the Department of the Interior. As the northern portion had not been investigated by any other organization, the Commission of Conservation undertook exploratory surveys of the principal rivers in this region, the investigations covering the Athabaska, Peace, Slave, Nelson and other smaller rivers. The rivers were traversed, generally, by canoe, the descent of the falls or rapids being levelled, flow measurements taken, and other details connected with the feasibility of development noted.

For the rivers further north, information was obtained from the reports of explorations made by the Geological Survey, the data being compiled from reports and maps of this branch and from the explorers' notes, which were courteously placed at the disposal of the Commission. In this region, generally speaking, the information available respecting the different rapids and falls is confined to a statement of the vertical descent, but, in many cases, the geological formation and distances from head to foot of the rapids are also given, as this information may assist in deciding the feasibility of development.

The southern portion of the Prairie Provinces may be divided into three sections, having widely different water-power characteristics:

1. The portion in the vicinity of Lake Winnipeg, in the east.
2. The more level portion in the centre.
3. The mountain and foothill country in the west.

In the first, or eastern portion, the Winnipeg River is the main feature. This river, with its drainage area of 53,500 square miles, has a well-regulated flow and affords numerous water-powers of immense value. Two of the sites have already been developed and supply the city of Winnipeg with its electrical energy, while construction work on some of the other sites has either been commenced or is on the eve of starting. Numerous smaller streams in this eastern portion also afford splendid opportunities for water-power development, some of them being actually utilized on the Minnedosa and Shell rivers. This section also includes the Grand Rapids of the Saskatchewan River, where a head of 80 feet is available, affording an exceptionally good power site.

Middle Portion Unfavorable to Development

The second, or middle portion, is traversed by two main arteries, the North Saskatchewan and South Saskatchewan rivers. These, with their main tributaries, flow with an even, moderate current with no concentrated descents of importance. Although, strictly speaking, this portion is not entirely without water-powers, yet the possibilities of such are rather unfavorable. In almost every case the total head would have to be created and several proposed developments have already been abandoned on account of the high cost of development.

The third portion, of which the Bow River is typical, has many valuable water-powers. There are none of unusual size, those on the Bow River itself probably being the most important. The slopes of the streams, characteristic of a mountainous region, are generally very steep, and, while the flow of water is subject to fairly large variation, good opportunities for storage and artificial regulation are afforded.

With regard to special measures taken by the Dominion Government in connection with the administration of the water-powers in the southern portion of the Prairie Provinces, the setting aside of the eastern slope of the Rocky Mountains as a forest reserve, known as the Rocky Mountains Forest Reserve, may be mentioned first. This step was taken on the recommendation of the Commission of Conservation, and, as a result, an area of 17,900 square miles has been assured protection from such denudation as has already taken place in some of the older provinces. All the upper tributaries of the North Saskatchewan and South Saskatchewan rivers have their sources within this area, and the beneficial effect of conserving its forest cover is evident as far east as the Grand Rapid on the main Saskatchewan River. With a similar object in view, the Commission has recently recommended that steps be taken to segregate, as a forest reserve, the upper portion of the drainage area of the Winnipeg River.

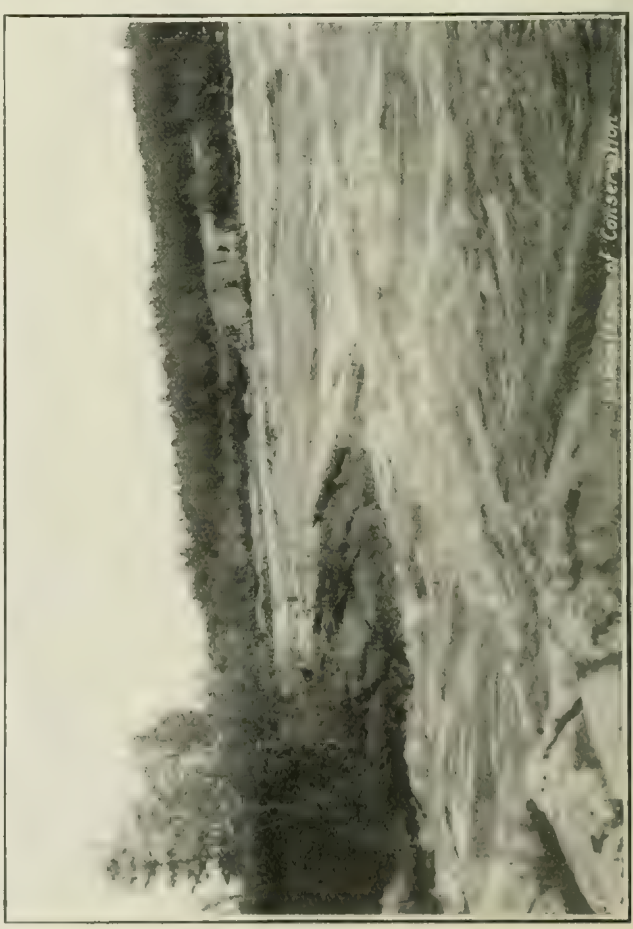
Water Powers on the Winnipeg River

Winnipeg River is one of the most notable power rivers on the continent; it flows in a westerly direction, connecting the Lake of the Woods with Lake Winnipeg. The basin drained comprises an immense area of some 53,500 square miles. As is typical of Laurentian country, the area is dotted with innumerable muskegs and lakes, the latter varying in size from small ponds to the Lake of the Woods, with an area of 1,500 square miles. Since practically the entire basin is of Laurentian formation, containing areas of overlying soil of glacial origin, certain general characteristics apply to the drainage basin as a whole. The country is rough and hilly, with large areas of rock outcrop. This latter feature applies in the main throughout the Winnipeg River, and lends itself to a characteristic formation throughout the river channel, which is of exceptional value in the interests of power development. The larger proportion of the river bed in the Province of Manitoba consists of a series of deep, cup-like basins, forming small, lake-like expanses, with little or no current. The river flow finds its way from these basins by falls and rapids over the rock formation, which is always in evidence at the outlets, and which forms both the means of egress from and the controlling feature of the basin water

Winnipeg River—Little du Bonnet Fall

Winnipeg River—Grand du Bonnet Fall (Second Pitch)

Winnipeg River—Second McArthur Fall



Winnipeg River—Pine Fall

level. These falls form the natural power sites along the river.

Estimates of the daily flow of the Winnipeg River have been compiled by the Manitoba Hydrometric Survey, based on discharge measurements secured by them, together with results of measurements supplied by Col. Ruttan, D. A. Ross and the city of Winnipeg power engineers. These estimated discharges extend over a period of eight years. For this period, a maximum flow of 53,400 second-feet and a minimum flow of 11,700 second-feet have been recorded. The high water marks along the shore indicate that floods of 100,000 second-feet have occurred, but such freshets take place only at rare intervals.

The question of storage on the upper waters of the Winnipeg River is, at present, somewhat involved, inasmuch as the regulation of the Lake of the Woods is an international question, and is now before the International Joint Commission. As the lake has a tributary drainage area of 26,400 square miles and a surface area of 1,500 square miles, offering unexcelled storage facilities, it is of vital importance to the powers of the Winnipeg River that storage should be had on this lake. Partial regulation of the drainage tributary to Rainy Lake is now controlled on Rainy Lake by the dam of the Ontario and Minnesota Power Company at Fort Frances. By the establishment of storage reservoirs on the English River, the flow of the latter can be regulated; and, in conjunction with storage on the Lake of the Woods basin, a very complete regulation of the flow of the Winnipeg River in Manitoba can be attained.

Power Sites Developed

Point du Bois Fall is utilized by the city of Winnipeg to generate power for its municipal electric plant. The natural fall was from 33 feet to 28 feet, depending upon the stage of the river, and the dams, as now constructed, increased the fall to 48 feet and 44 feet at low and high water stages, respectively, while the normal head is 45 feet. There was, originally, a stretch of slack water, eight miles long and about 3,600 acres in area above Thirty-foot and below Lamprey Falls. It has been increased by the development works to 6,500 acres, and is of considerable advantage in the operation of the plant. The present installation consists of five units of 3,750 kw. and three units of 5,100 kw. capacity, making a total of 34,050 kw. Future extensions are planned which will accommodate eight additional units of 5,100 kw. each.

The Winnipeg Electric Railway Company's power-house is constructed on the Pinawa branch of the Winnipeg River. The development work involved much rock cutting and the construction of a diversion weir, which raises the water by about six feet at the head of the channel. The head utilized is 39 feet and the generating equipment consists of four units of 3,000 kw. and five units of 1,500 kw. each, giving a total capacity of 19,500 kw.; but a greater load than this has been carried on the plant.

Government Power Proposals

The cost estimates for the government power proposals on the Winnipeg River refer in all cases to the capital cost of installation, and are based on both an initial and final development. The initial development is designed to utilize at each site the present minimum flow of the river, i.e., 12,000 second-feet, or such portion of it as may be available at the particular site in question. The final development is designed to utilize, at each site, a regulated flow of 20,000 second-feet, or such portion of it as may be available at the site. After the diversion of sufficient water in the Pinawa channel to properly operate the plant of the Winnipeg Electric Railway Company under normal peak-load conditions, there would remain for use at Seven Sisters, in the main river, about 4,000 and 12,000 second feet under unregulated and regulated conditions of the river, respectively. It is important to note that it is on this basis the available power at the Seven Sisters site is discussed.

To compare the power sites on a rational and equitable basis, all the layouts and designs have been standardized insofar as possible, giving full consideration to the varying heads and to the local physical conditions at each individual site. No allowance has been made in the estimate for transmission, the costs being in all cases the capital cost for power on the low tension switchboard in the power-house, and the power being considered as straight 24-hour service at 75 per cent. efficiency, based on the flow. This forms a very conservative basis. Transmission costs are omitted from the estimates, as it is impossible to foretell the use to which the power at the various sites may be applied when developed, and a straight comparison of the sites as they stand is desired.

In all cases the dams are designed in solid concrete, with ample discharging capacity to pass the severest floods to be anticipated. The power stations have been developed on single runner, vertical turbine installations, varied for the different heads and to meet local conditions.

Slave Fall Site.—The proposed development at Slave Fall concentrates a head of 26 feet, formed by the combination of Slave and Eight-foot falls. The dam runs along the crest of the fall, and, curving downstream, through an arc of about 90 degrees, connects with the power station on the right bank of the river. Provision has been made for the future installation of a lock on the left bank. The head-water elevations, as at present proposed, are 928 and 902 respectively. The initial installation, upon which the estimate is based, provides for eight 5,000-h.p. turbines, sufficient to provide for a flow of 12,000 second-feet at eight-tenths gate, with a spare machine for emergencies. On a 75 per cent. efficiency, 24-hour basis, 26,600 h.p. will be available at a capital cost of $87.50 per horse-power at the low tension switchboard. The final installation provides thirteen 5,000-h.p. turbines, sufficient for a flow of 20,000 second-feet, at eight-tenths gate, with a spare machine for emergencies. On a 75 per cent. efficiency, 24-hour basis, 44,400 h.p. will be available, at a cost of $77.40 per horse-power at the switchboard.

Upper Pinawa Site.—This site is about three miles above the Winnipeg Electric Railway Company's plant on the Pinawa channel. It utilizes a hitherto inconsidered source of power in what may be termed the headrace of this company's plant. The head to be developed here will normally average 18 feet, with the head and tail-waters at elevations 899.5 and 881.5 respectively. A flow of 8,000 second-feet will produce 12,300 continuous twenty-four hour power at 75 per cent. efficiency. To develop this power an installation of four 4,500 h.p. turbine units has been assumed, the capital cost of the installation being $104.05 per horse power on the low tension switchboard on a basis of twenty-four-hour power.

Upper Seven Sisters Site.—The Upper Seven Sisters site is situated about four miles above the lower. The tail-water, under normal conditions in the river, will be at elevation 870, i.e., the proposed head-water elevation of the plant below. The head-water level has been placed at an elevation of 899, giving a normal head of 29 feet. Since, to properly operate the existing development of the Winnipeg Electric Railway Company, an average flow of 8,000 cubic feet per second is assumed down the Pinawa channel, it will not be feasible to develop the Seven Sisters site until the flow has been regulated to a minimum of 20,000 cubic feet per second. Assuming the use of 12,000 second-feet, the power station provides for a complete installation of eight 6,000-h.p. units, providing a spare unit for emergencies. The estimated output on the low tension switchboard at 75 per cent. efficiency is 29,600 horse-power, 24-hour service. The estimated capital cost per horse-power would be $92.

Lower Seven Sisters Site.—The Lower Seven Sisters site is situated about 19 miles above the McArthur site, and contemplates the development of the lower five descents of the Seven Sisters Fall. The tail-water elevation has been assumed at 833, six feet being allowed for the hydraulic gradient in the river between the site and the regulated lac du Bonnet. The head-water is placed at elevation 870, the river banks permitting this raising of the water without necessitating embankments. A head of 37 feet will be available under normal conditions. The power station provides for a complete installation of six 10,000-h.p. turbine units, sufficient to utilize a flow of 12,000 cubic feet per second. On a 24-hour and 75 per cent. efficiency basis 37,900 horse-power will be available, at an estimated capital cost of $90 per horse-power, on the switchboard.

McArthur Site.—At the lower of the two McArthur Falls, a head of 18 feet awaits development. The river is here divided into two channels by a large island. The general project consists of a solid concrete spillway, along the crest of the fall on the right or main channel, and a long spillway and embankment, including sluiceway provision, running diagonally across the island and connecting with the power station spanning the left channel. Provision is made on the island for the future construction of a lock. The head-water elevation is at present fixed at 827, i.e., about the highest recorded water level of lac du Bonnet. The tail-water is proposed at 809, giving a head of 18 feet. The initial installation provides for eleven 2,500-h.p. turbines, sufficient to provide for 12,000 second-feet at eight-tenths gate, with a spare machine for emergency. On a 75 per cent. efficiency, 24-hour basis, 18,400 h.p. will be available, at a capital cost of $110.40 per horse-power at the switchboard. The final installation provides for seventeen 2,500-h.p. units on a basis of a 20,000 second-feet flow, and 75 per cent. efficiency, 24-hour power, i.e., of 30,700 h.p. The cost per horse-power on the switchboard is $89.25. This site can be given a much more favorable aspect, when the local storage available in Lac du Bonnet (whose 32 square miles form the head-waters) is taken into consideration.

Du Bonnet Site.—The proposed scheme of development at the Du Bonnet Falls will ultimately concentrate there a head of 56 feet, made up of the Grand and Little du Bonnet falls and Whitemud fall. The latter will be removed by blasting out the rock-dam over which the present fall flows. The dam, consisting of embankment, spillway and sluiceway sections, leaves the left bank and crosses the river on the brink of the Little du Bonnet fall, connecting with the power station which parallels the right shore line below the pitch. Ice sluices and embankment connect the power station with the high land on the right bank. Provision is made for future lockage facilities on this bank. The head-water elevation has been fixed at 808, with the tail-water at 762 previous to the blasting out of the Whitemud fall, and 752 subsequent thereto. This secures a head of 46 feet for the preliminary, and 56 feet for the final installation. The initial installation is figured on seven 10,000-h.p. turbine units, utilizing 12,000 second-feet at eight-tenths gate and 46-ft. head. This, on the foregoing basis, will render available 47,100 horse-power, at a capital cost of $77.20 per horse-power, at the low tension switchboard. An intermediate installation, comprising 12 units, providing capacity for 20,000 second-feet at 46-ft. head, and producing 78,700 horse-power, has also been estimated. The cost of the power at the switchboard for this intermediate installation is $66.70 per horse-power. The final installation consists of fourteen 10,000-h.p. units for the development of 20,000 second-feet at 56-ft. head, the extra ten feet being secured by the removal of the Whitemud fall. On the above basis, 95,500 continuous horse-power will be available at a cost of $68.60 per horse-power on the switchboard.

TABLE OF DEVELOPED AND UNDEVELOPED POWERS ON THE WINNIPEG RIVER IN MANITOBA

Plant or site	Head-water, elevation	Tail-water, elevation	Head	Turbine capacity at full gate at Govt. proposals		H.P. at 75% efficiency on a 24 hr. basis		H.P. developed	Capital cost per h.p. on switchboard		Remarks
				12,000 sec.-ft.	20,000 sec.-ft.	12,000 sec.-ft.	20,000 sec.-ft.		12,000 sec.-ft.	20,000 sec.-ft.	
									$ cts.	$ cts.	
Winnipeg municipal plant	975.7	930.7	45			46,100	76,800	25,000			47,000 h.p. installed.
Slave Falls site	928	902	26	40,000	65,000	26,600	44,400		37.50	77 40	
Winnipeg Electric Railway Co. plant	879.4	840.4	39					28,200			On Pinawa channel. 34,000 h.p. installed.
Upper Pinawa	899.5	881.5	18	18,000	18,000	12,300	12,300		104.05	104.05	On Pinawa channel.
Upper Seven Sisters site	899	870	29		48,000	9,900	29,600			92.00	Less discharge down Pinawa channel.
Lower Seven Sisters site	870	833	37		60,000	12,600	37,900			90.00	Less discharge down Pinawa channel.
McArthur site	827	809	18	27,500	42,500	18,400	30,700		110.40	89.25	
Du Bonnet site	808	762	46	70,000	120,000	47,100	78,700		77.20	66.70	Preliminary head.
		752	56		140,000	57,300	95,500			68.60	Final head.
Pine site	750	713	37	60,000	100,000	37,900	63,100		80.70	69.80	

Total power with unregulated river (12,000 second-feet min. flow) is 249,300 horse-power.
Total power with regulated river (20,000 second-feet reg. flow) is 418,500 horse-power.
Total power developed to date, 53,200 horse-power.

Pine Fall Site.—The Pine fall development will concentrate the natural descent of the Pine and Silver falls, giving a head of 37 feet. The dam runs diagonally across the river from the right bank and joins directly to the power station, which forms a continuation of the dam. The power station is connected with the high ground on the left bank, by sluices and embankment. Provision is made for lockage facilities on this bank. The head-water and tail-water elevations have been placed at 750 and 713 respectively. As the tail-water is practically Lake Winnipeg level, it will vary slightly from year to year with the level of the lake. The initial installation is placed at six 10,000 h.p. turbine units using 12,000 second-feet at 37 feet head. On the foregoing basis, this will render available 37,900 h.p. at a capital cost of $80.70 at the low tension switchboard. The final installation consists of ten 10,000 h.p. units for the development of 20,000 second-feet, rendering available 63,100 h.p. at a cost of $69.80 per horse power.

Summary of the Power Possibilities of the Winnipeg River

The developed and undeveloped powers of the Winnipeg River, under regulated and under unregulated conditions, are tabulated in the table herewith. The undeveloped power is considered on a 75 per cent. efficiency, 24-hour basis, and the capital cost per horse-power is given in terms of this power, estimated to the switchboard in the power-house.

The Dealer and Contractor

The Contractors' Wednesday Nite

The Electrical Contractors of Toronto Prove their Ability to Get Together—Having Become Thoroughly Acquainted they Hold a Fully Attended Farewell Dinner to Celebrate the Departure of their Old Friend "Disorganization."

By "Onlooker"

CHAPTER I.

A poor lonesome jobber, bored by the continual influx of orders and burdened by the thought of a heavy stock bought last year, wearily opened a letter. His brow wrinkled at first and then cleared as he placed the epistle in his filing basket. It was merely a note from those contractors, asking him to attend their open dinner on the following "Wednesday Nite." "He would, if he could, but if anything else turned up he couldn't." Thus did he pass the subject from his mind.

A few days later in fluttered an impetuous little postal card with lots of blank spaces and capital letters.

———— Hotel Wednesday Nite (7.30)

No Speeches!

Nothing to do but enjoy yourself!
Everything on the program entirely new!
Electrical Contractors and friends only!
Don't worry about dress! WEAR A SMILE!"

"SPEECHES!" thought he. "Locknuts and Bushings!' There's no such thing as a dinner without speeches. That sounds promising! Don't have to don the glad rags, but wear ——— a smile! Where can I get a smile? I'll look into this.

"Central, Main 2387, please! —— Hello! Mr. Contractor, what's doing Wednesday N-I-T-E? Be ye goin' to tell us how naughty we terrible jobbers are, cutting prices all the time and giving you no protection at all?"

"Not much, Mr. Jobber, you wouldn't do a thing like that, would you? However, we contractors are through calling names, and we want you to come to dinner with us so we can get real well acquainted. We are working on the get-together principle now and we find it simply ruins hard feelings."

"Very well, Mr. Contractor, I'll do my best to be there. When is it? Tomorrow N-I-T-E? All right. Thanks for your kind invitation. Good-bye."

Carefully he gave the card a conspicuous place on his desk, at the same time determining to go to that same dinner of the contractors and look 'em over.

That evening at home came the wifely question, "Jobber! What are you doing tomorrow night?"

"I'm going to a little dinner given by some of my good customers."

"No, you're not. You stay right here! The Joneses and the Campbells are coming and you must stay to crank the Victrola! Not another word!"

"As you say, M'dear," was the meek and resigned reply from the lion of the office.

But again came morning and the office with its monotonous stacks of orders and, on top, another postal card. "What's this?——

Extra! Extra!! Extra!!!

Don't go to the ———— Hotel!
We won't be there!
We will be THERE at—
The Board of Trade Rooms, 20th Floor, Royal Bank Building.
The STUNT is coming off sure!
So WEAR THAT SMILE!

A "STUNT coming off"? ——— Mystery this time!

WEAR THAT SMILE! Evidently one must wear a smile to be admitted.

"Miss Brown, 'phone Mr. Contractor, please, and say I will be THERE to-night."

Belmont 1-0-0-0-0! Do hurry, Central.

Is that you, Dearie?—— So sorry. Really must disappoint the people tonight. Business reasons absolutely necessitate my being at that dinner. Sorry—— Sorry ——.

CHAPTER II.

Fearlessly that night did Mr. Jobber jump up his front porch steps, three at a time, for was not the hour but 11.15, and did he not wear a smile like "Sunny Jim?" Mrs. Jobber, awaiting within, relieved at the early end of her all-night vigil, queried, "Good time?"

"Best ever!"

"Tell us about it."

"Well, you see, I worked at the office till it was time to go over to the Board of Trade. This dinner was announced for 7.30, and, despite the fact that such affairs usually are late starting, I wanted to break the rule by being on time myself.

"No sooner had I arrived and checked my coat than I was placed in line, had my ticket examined by one man, a tag written out for me by another, while a third tied the blamed thing onto me. Then I, bearing the startling legend,

STOP! LOOK!! LISTEN!!!

This label is tied to

Mr. Jobber! ——————

What's your signature?

was gently propelled all by myself through an opened door into utter darkness, the door closing behind me.

"A huge figure, looming up so gradually as to seem to come out of the darkness itself, ceremoniously shook forth a large serviette, in one operation deftly searching my pockets (apparently for concealed weapons or a length of two-inch conduit), and securing the linen as though it were an apron symbolic.

"For half an hour, with almost eighty others, figuratively and literally I was kept in the dark as to what was to happen next. Promptly at 8.00 the lights came on and we were able to read each other's tags, which, by the way, showed variety in wording. They served as effectual introductions.

"The solemn rites had but begun, for a contractor at still another door began at once to call forth, one by one, the victims. Responding to my name, the door was opened for me, my name called sharply, and again ——— Stygian blackness.

"This time, fortunately, a fair guide, or guides, provided with a flashlight piloted me through the channel, between rows of tables and chairs, to my final resting place.

"Shortly all were seated, still in darkness, and several slides were flashed on the screen. First:—

The Electrical Contractors of Toronto
Welcome their Friends, and ———

then:

Feel sorry for those who are not here.

and

Please Rise!

followed by

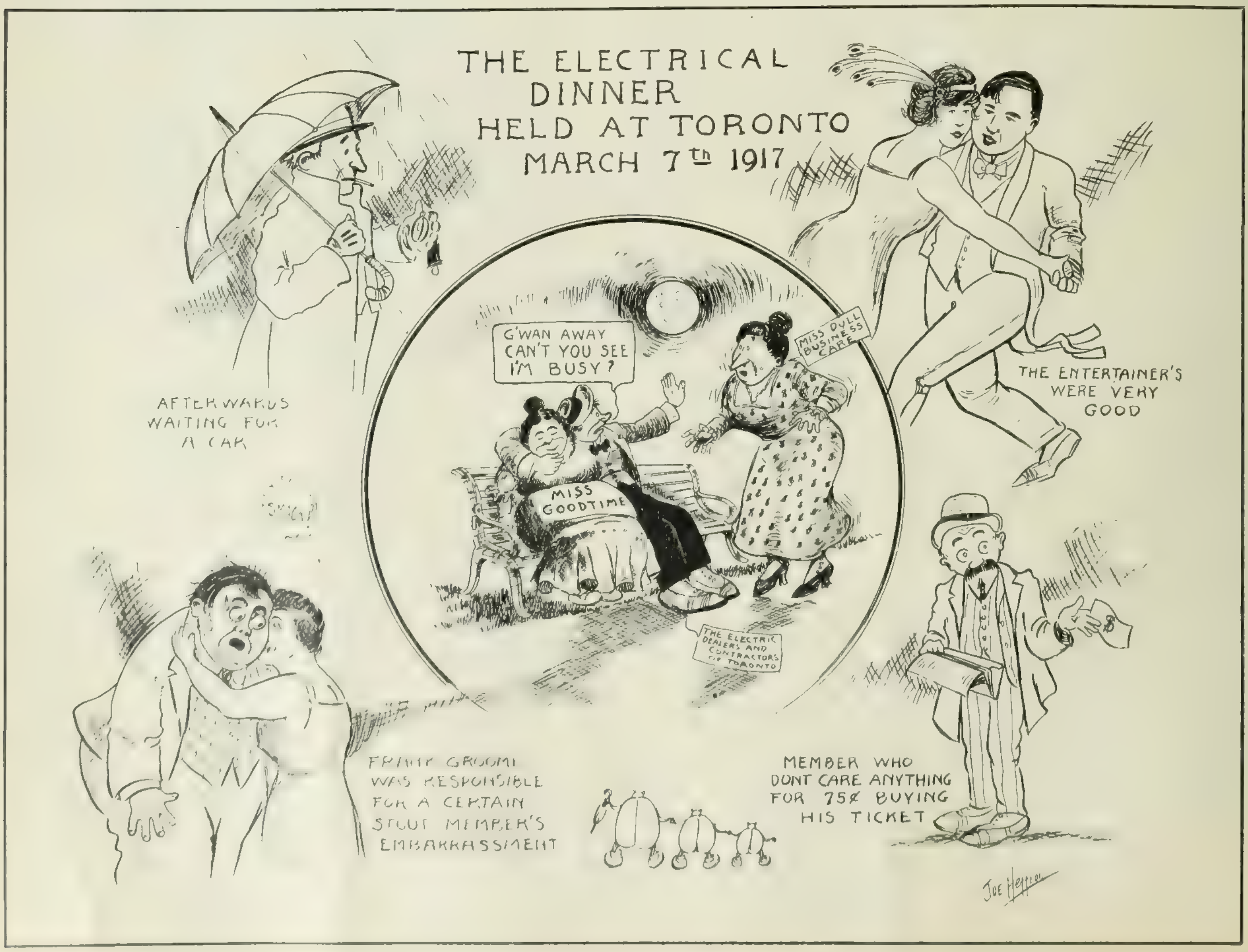
God Save the King!

"Simultaneously with the opening chord by the orchestra and, at last,—— lights.

"No sooner were we seated than again the lights went out, though for but a brief interval, to show the silent and pointed instructions—Ready!—Fall to!—Watch your step—and with the lights came dinner.

"After becoming accustomed to the clatter of spoons and the splash of the soup, I soon discovered myself flanked by contractors, neither of whom I had ever met. The entire company, in fact, was well assorted as to seating, and showed a good representation from the jobbers, manufacturers, sales agents and the inspection departments.

"Before we had finished soup, the lights went out to announce that a terrible mistake had occurred. Frank Groome was tied to the wrong tag! With great ceremony, the official tag-tier advanced to correct the gross error without delay, the proper label proving to be greatly overgrown, and bear-


THE ELECTRICAL DINNER HELD AT TORONTO MARCH 7th 1917
AFTERWARDS WAITING FOR A CAR
G'WAN AWAY CAN'T YOU SEE I'M BUSY?
MISS DULL BUSINESS CARE
MISS GOODTIME
THE ELECTRIC DEALERS AND CONTRACTORS OF TORONTO
THE ENTERTAINER'S WERE VERY GOOD
FRANK GROOME WAS RESPONSIBLE FOR A CERTAIN STOUT MEMBER'S EMBARRASSMENT
MEMBER WHO DONT CARE ANYTHING FOR 75¢ BUYING HIS TICKET

ing special and significant wording, to which our attention was drawn.

"To make a long story short, the speechless evening really happened. All announcements were made on the screen and the lights frequently failed as friendly gibes appeared, centering attention on Art. Hall, the inspector villain, and others. They showed some funny pictures, too, of George Beattie, Joe Rogers, and Walter Warren, the latter shown in a characteristic attitude. These pictures were drawn from life on the spot, by Joe Heffron. They surely were clever, and added greatly to the evening's enjoyment.

"Dinner finished, they sprung on us a feature film in five acts that was a real reel headliner. The excellence of the projection was entirely due to the personal interest of our old friend, Harry Coleman.

"Interpolated in the fourth act intermission came the surprise of the evening in the form of a cute, energetic and able maiden, Titian-headed. With her sparring partner she put on several specialties, including songs, dances and picturesque acrobatics. She instantly and consecutively fell head over heels in love with Ross Oborne, on account of his lovable disposition; Walter Warren, whose tempting curl her fingers simply could not resist; and Joe Whelan, on whose exalted brow there still appears, no doubt, the imprint of her unrestrained ruby lips."

"Tell me," said friend wife. "It doesn't seem like you at all to sit idly by and let all this happen to somebody else!"

"Didn't have a chance! Groome sneaked forth and escorted the young lady from the room!

"To come back. After the commotion had subsided, and the somewhat proudly embarassed recipients of fortune's favor had bowed acknowledgement, the fifth and last film act was shown.

"At the very end, the screen informed us that at the first dinner, November 22, 1916, but 38 contractors were present, while tonight there was a turn out of 49. Together with 31 friends, this gave an attendance of 80, all electrical and all enthusiastic. It was announced that by the time of the next open dinner, the Contractors' Association will be an accomplished fact.

"On the way out tickets were being sold for the next dinner, April 4th, and I made a rush for the head of the line.

"I felt decidedly disappointed to learn that this is to be the dinner at which definite plans for organization are to be discussed, and that it is for contractors only.

"Do you know, I almost wish I were a contractor. They seem to be a splendid lot of men when you get to know them, and I sure do envy them those dinners. I would not have missed this one for anything."

"Well, Jobber, you can go to the next open dinner if you promise me one thing. Bring me home a little electric motor to run the Victrola."

CHAPTER III.

"The morning after."

Jobber: "Mr. Contractor, I just called you up to congratulate you on the success of your dinner last night. It was splendid!"

Contractor: "Thank you, Mr. Jobber. We like to feel that everybody enjoyed themselves."

Jobber: "They certainly did. I never had any idea that you boys were getting along so well together. You are discussing organization at your next dinner?"

Contractor: "Yes. We feel the time has come to let our united feeling have definite and concrete expression by final organization. We feel that we should be a body actually in existence, with money in the bank, ready to face any problem that may come to us as an association. In other words, preparedness is our program."

Jobber: "This must requisition a great deal of your time?"

Contractor: "Yes, it does. But we are now handling things with the minimum of effort.

For example, we desire to obtain the ideas of each contractor as to the salient features of the ideal organization for us here in Toronto. We are sending out to each man a form, asking seven questions. This form he is to return answered, for the guidance of the committee in making their organization report."

Jobber: "How will you get your attendance without personally selling a ticket to each man?"

Contractor: "In the first place, we sold 42 tickets last night. Since our mailing list includes more than 80, we have disposed of half. We are notifying the others that their tickets can be obtained only at 410 Kent Building before March 31st. We are satisfied that we have, for the past seven dinners, put forth every reasonable effort to reach every man. It is not fair to expect us to devote our time to merely selling tickets. The least the desirable contractor can do is to make just one trip down town during the next three weeks and buy his ticket."

Jobber: "Will your rule be hard and fast?"

Contractor: "Yes! No ticket will be obtainable after March 31st, not even at the hotel just before the dinner. There is a ticket for every man, numbered and with his name on it. That ticket admits no one else."

Jobber: "How about the man who may find it impossible to get down town before the time limit expires?"

Contractor: "All he needs to do is to mail in his 75 cents and his ticket will be forwarded to him the same day."

Jobber: "Well, to my way of thinking, you have the right idea. You have enough of the boys now to forget the others who will not lend a hand. It is their own loss. Why not raise the initiation fee to all joining after the charter membership is complete?"

Contractor: "That question will be taken up."

Jopper: "Go to it, Old Man. I wish you every success!"

The Electrical Inspection Department is Moving

The following brief resume will indicate to electrical contractors the extent to which the Inspection Department of the Ontario Hydro are endeavoring to have their regulations and rules respected:

Up to date there have been six people in the city of Toronto fined $10 and costs for not having taken out permits to do wiring. There have also been, in the city of Toronto, two convictions for the same offence, and the fine has been $30 and costs. There is also another case in which sentence will be imposed and the magistrate states that the fine will be $20 and costs. This case is particularly interesting, inasmuch as the magistrate sent the wireman back and ordered him to do the work over again because it was defective, and to come back and receive sentence, which he stated would be $20 and costs.

One man was subpoenaed to court for refusing the inspector admission to his premises, and was let off with a warning by the magistrate. Another man was subpoenaed for

Electrical Contractors
of Toronto

Your Organization Dinner

Wednesday Night, April 4th

Tickets may be obtained from K. A. McIntyre, at 410 Kent Building, up to March 31 only. No money can buy a ticket after that date.

doing wiring without a permit in a picture booth, but the case was withdrawn to be dealt with by the inspector of moving picture theatres.

Two parties were fined in the city of Hamilton, one for installing wire in a fuse holder and the other for doing wiring in a house after final certificate had been issued, without permit. $5.00 and costs was imposed in each case.

Two parties were brought before the magistrate in Preston, one being fined and the other dismissed with a warning, both for having done wiring without a permit. We do not know at the time of writing what this fine was.

Another party was brought before the magistrate at Ingersoll for doing wiring without a permit and was let off with a warning and costs.

In the city of London, another party was brought before the magistrate on the same charge and let off with a warning and costs. In the city of Guelph the same thing occurred. In the city of Guelph a large company was subpoenaed before the magistrate for failing to carry out the Commission's orders in removing defective wiring. The magistrate gave them thirty days to bring in the Commission's certificate or take the consequences. The company obeyed.

A large firm in the city of Woodstock was brought before the magistrate for doing wiring without a permit and was let off with costs on the defence that the work was done partly by another wireman and that the firm was not altogether responsible. The other party was brought before the magistrate on the same case. In this case both parties were warned and let off on payment of court costs.

In the town of Owen Sound a party was subpoenaed for doing wiring without a permit. The case was withdrawn upon payment of costs and assurance from the offender that he would observe the regulations in future.

It is evident from the foregoing that in the city of Toronto the magistrate fully appreciates the wisdom of enforcing the regulations, as they have imposed fines, and some very heavy ones, in all cases.

"Fans for Efficiency," the Summer Slogan

A "fan" there was to his employer dear, who buried his dear grandmother several times a year; he bought "a fan" and worked with such a vim, his employer raised his pay—and followed him

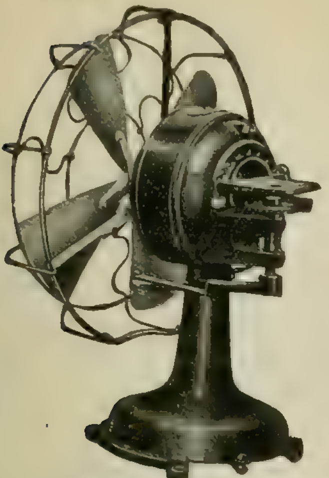
That season of the year that is generally spoken of as "Fan time" is again within hailing distance, and it behooves all dealers to be laying plans and placing orders for a summer supply. It is important that this matter should receive prompt attention this year, for various reasons. The supply is likely to be less easily available than in normal years, on account of the scarcity of materials. In addition to this, deliveries are very uncertain. There is also the natural increase in business which must accentuate both these difficulties, for there is little doubt that, slowly but surely, the electric fan is coming to be looked upon no longer as a luxury, but as one of the essential furnishings of the office, the factory and the home.

There is a change, too, gradually coming over the attitude of the public mind towards the electric fan. That it is something more than a "seasonal" article. Until within the very recent past a fan was looked upon as a luxury in the very hot weather, and, a little later, as possibly justifying itself by the greater efficiency of the worker. It is not even yet appreciated, however, though it has been proveen, we believe, beyond question, that a fan may be used to rectify a vitiated atmosphere with equal effectiveness whether in January or July, and will pay for itself in the increased quantity and improved quality of the work of the individuals coming under its influence, quite independently of the temperature conditions. This is a matter of education, however, and falls in the same category as, for example, proper lighting, the dollars and cents value of which is only just beginning to be realized by employers of labor.

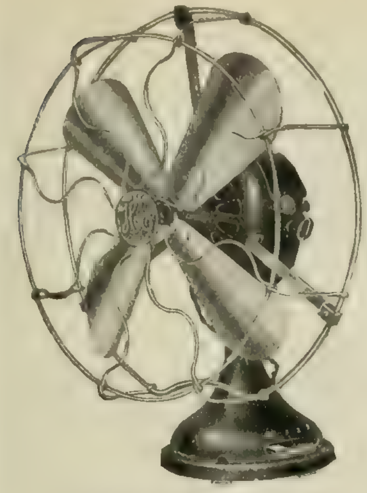
The electric fan, then, is no longer to be thought of or classed as a luxury. It is a tool with which to increase the amount of work that may be accomplished in a given period. It also tends, at the same time, to increase the quality of the product.

These, undoubtedly, are along the lines the salesman of electric fans will get the best results where he meets a customer that has to be converted. Draw attention to the amount of time lost through lassitude of employees—that tired feeling—brought about not nearly so much by over work as by poor ventilation. This also means carelessness and rejected products. Take even the case of ten employees in a room losing ten minutes a day in this manner. One hundred minutes is worth, say, fifty cents. A fan costs twelve dollars, perhaps, so that in this case the fan would pay for itself in twenty-four days. This is a conservative estimate for thousands of factories and offices. The cost of operation of an electric fan, of course, is almost nothing, often not more than one cent a day.

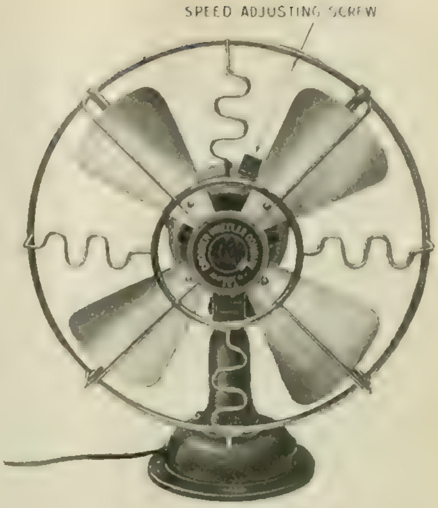
In the following pages we are showing a number of electric fans available for the coming summer's demand, along with the name of the manufacturer, and, where available, jobber from whom they may be obtained. These include such well-known firms as the Northern Electric Co.; Westinghouse Electric & Mfg. Co.; Canadian General Electric Co.; R. E. T. Pringle; Hamilton-Beach Mfg. Co.; the Adams-Bagnall Co.; Robins & Myers Co.; the Century Electric Co.; the Hunter Fan & Motor Co.; Knapp Electric Co.; A. C. Gilbert Co.; Menominee Electric Mfg. Co.; Federal Agencies, Winnipeg; Factory Products, Toronto; Ceneral Electric Supply Co., Toronto; Franke, Levasseur & Co., Montreal; Mechanics' Supply Co., Quebec; Munderloh & Co., Montreal; Crocker-Wheeler Co.; Lindstrom, Smith Co.; Emerson Electric Mfg. Co.; Fidelity Electric Co.; the Masco Company, Toronto; and the Carlton Co.



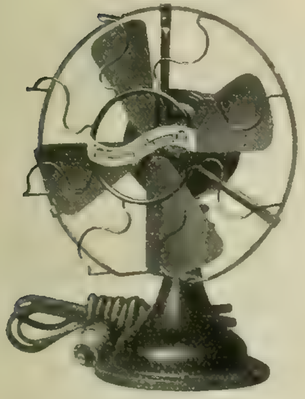
A.c. oscillating desk fan Fidelity Elec. Co.; Masco Co., Toronto; Benson Wilcox Co., London.



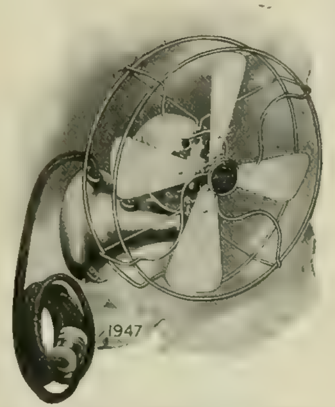
Hunter Fan & Motor Co.—R. E. T. Pringle, Canadian distributors.



9-in. a.c. type—Crocker-Wheeler Co.



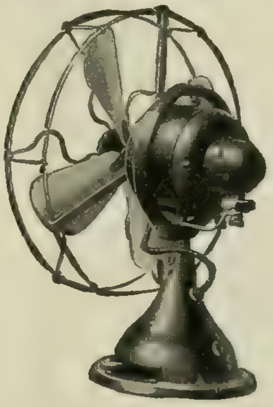
8-in. Whirlwind—Westinghouse



8-in., 2 speed, desk-bracket type Emerson Electric Company

Ceiling Gyrating Fan—Westinghouse.

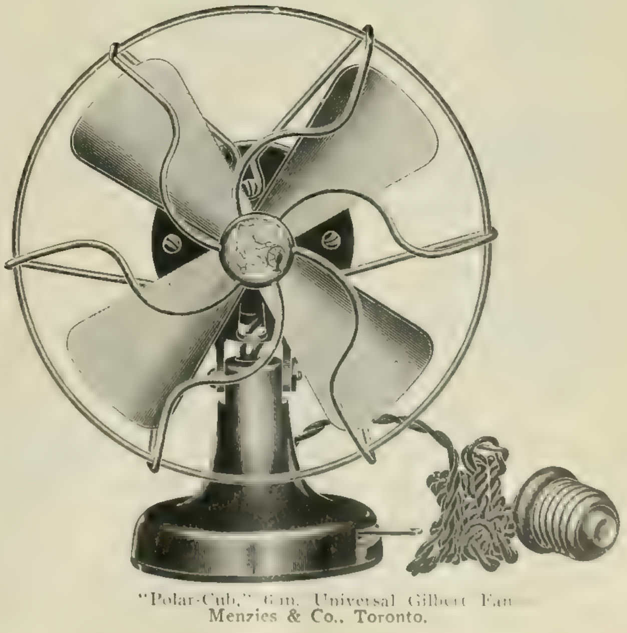
16-in. oscillating, residence type —C.G.E. Co.



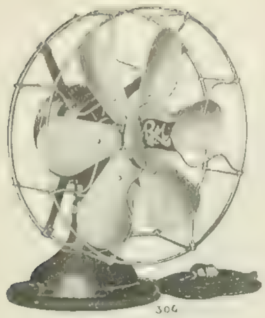
9 in. oscillating, 4 blade type C.G.E. Co.

32 in. a.c. ceiling fan Westinghouse; Northern Elec Co.

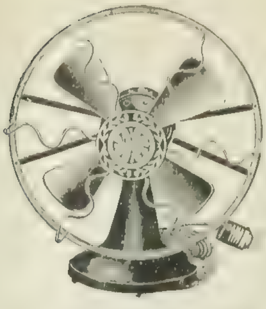
8-in., 6 volt, battery fan Knapp Electric Co.



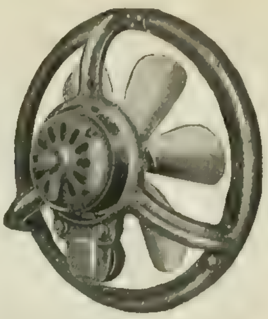
"Polar-Cub," 6-in. Universal Gilbert Fan Menzies & Co., Toronto.



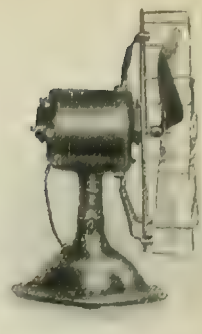
12 or 16 in. non-oscillating
Robbins & Myers



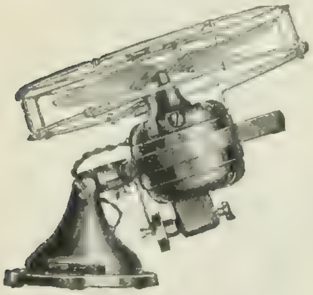
The Chicago, 8 in. Universal, Lindstrom Smith & Company, Chicago.



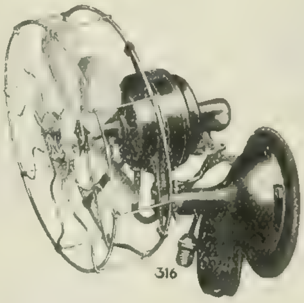
Ventilating Outfit Canadian General Electric Co.



12-in. Universal, Straight or Oscillating--Menominee Elec. Co., Menominee, Mich.; Masco Co., Toronto.

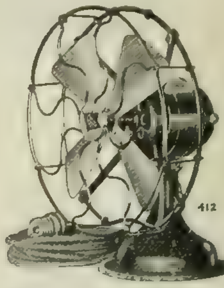


12 in. oscillating, 4 blade type C.G.E. Co.

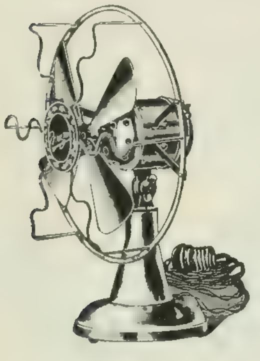


12 in. or 16 in. oscillator, Robbins & Myers

Fan Attachment for Sew E-Z Sewing Motor—Hamilton, Beach Co., Racine, Wis.

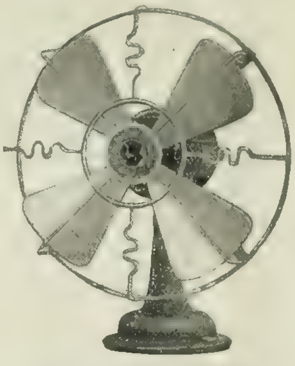


8 in., non-oscillator-
Robbins & Myers

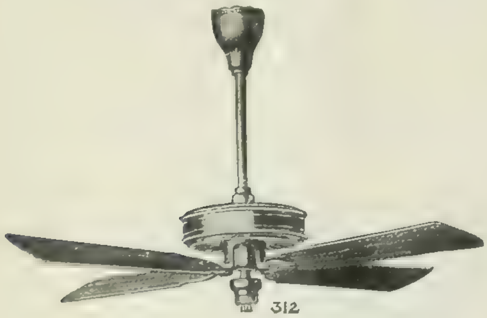


White Cross,—8-in. Universal, 110-220 volts,—Lindstrom Smith Co.

A.c. or d.c. 10-in. type
Knapp Electric Co., N. Y.



9-in. d.c. fan—Crocker-Wheeler Co., Ampere, N.J.



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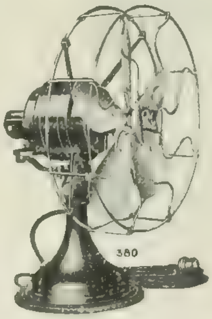
Style H. a.c. ceiling fan—
Robbins & Myers, Springfield, Ohio.

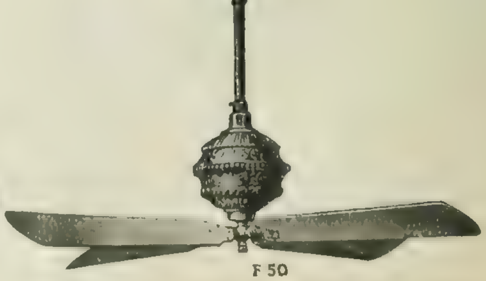


9 in. oscillator—Robbins & Myers

Counter-column, gyrating—Westinghouse Elec. & Mfg. Company

52-in. [illegible] ceiling fan, C.G.E. Co.

6 blade, 10 in., non oscillating—Westinghouse.



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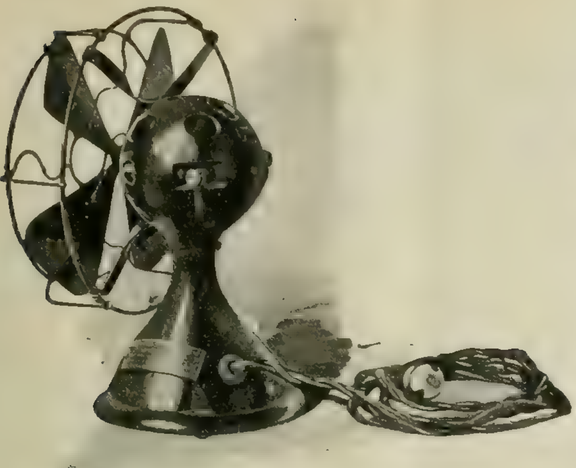
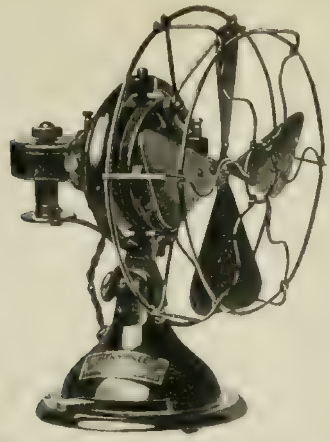
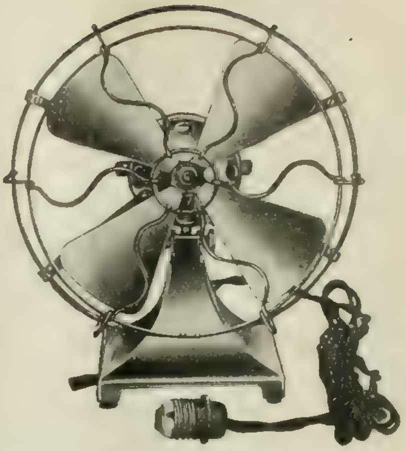
Style B, d.c. ceiling type Robbins & Myers.



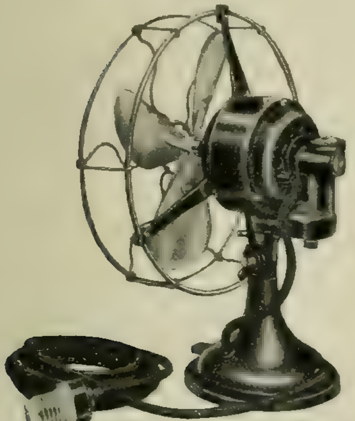
8-in., 4 blade Menominee Elec. Co.; Masco Co., Toronto.



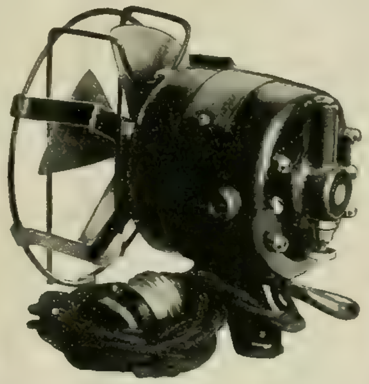
8-in. Universal, bracket or oscillating – Menominee Elec Co.; Masco Co., Toronto.



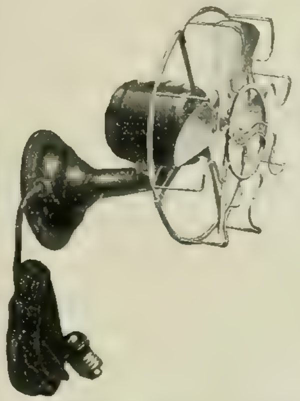
The Cyclone, 8 in. Universal Hamilton, Beach Company



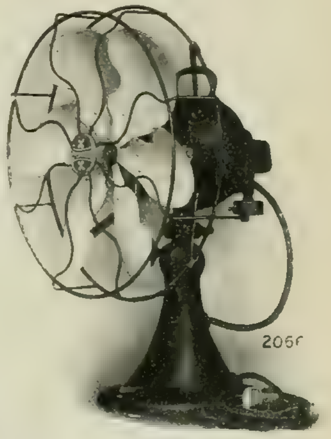
9-in. oscillating, desk or bracket, a c. type—Century Electric Co.



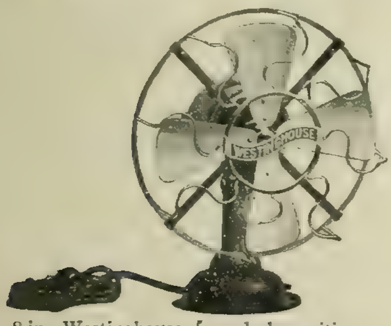
Pittsburgh Electric Specialties Co., Pittsburgh.



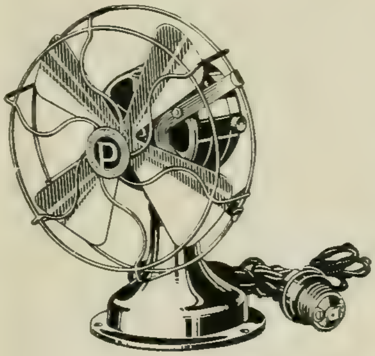
8-in. Westinghouse fan, bracket position—Northern Elec. Co.



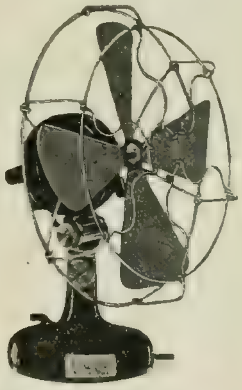
6 blade, slow speed, 12-in. d.c. fan,—Emerson Electric Co., St. Louis, Mo.



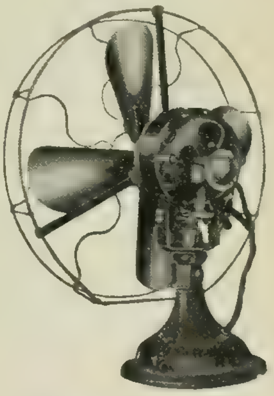
8-in. Westinghouse fan, desk position—Northern Electric Co.



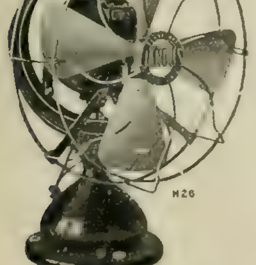
Pittsburgh Electric Specialties Co.



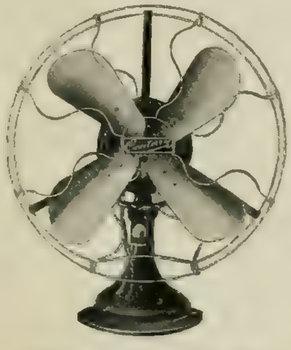
8-in., 110 volt, Universal motor, Carlton Fan—G. W. Moss, 701 Yonge St., Toronto.



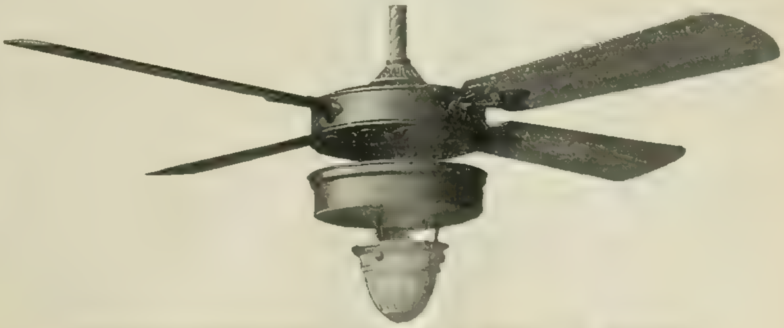
12-in. and 16-in. oscillating model-Century Electric Co.



D. C. desk and bracket fan, oscillating. Adams-Bagnall type, 12-in. and 16 in. sizes -R. E. T. Pringle, Can. Agents.



12 in. and 16-in. desk fan - Century Electric Co., St. Louis.



Ceiling fan with Brascolite unit Northern Electric Co., Montreal.

Current News and Notes

Aylmer, Ont.

A by-law will, in all probability, be submitted to the ratepayers of Aylmer, Ont., authorizing an agreement with the Hydro-Electric Commission of Ontario.

Cataract, Ont.

Considerable damage was done to the generating plant of the Cataract Electric Company, of Cataract, Ont., on February 25, as a result of their 6,000-volt line becoming crossed with a hydro-electric 22,000-volt transmission line. William J. Gibson, who attempted to cut the wires and save the plant, was electrocuted.

Coaticook, Que.

A water power. development is contemplated by Penman's Limited, Coaticook, Que. The proposal is to erect a power-house, construct concrete dam, and install 180 h.p. turbine and generator.

Cornwall, Ont.

It is reported that the Cedars Rapids Transmission Company will build a transforming station at this point, having an initial capacity of 3,000 h.p. The plant will be so designed, however, as to permit of extension as the demand for power increases.

Hamilton, Ont.

The Bell Telephone Company, Montreal, will shortly call tenders for a substation, to cost $30,000, in Hamilton, Ont.

Merrickville, Ont.

The ratepayers of Merrickville, Ont., recently carried a by-law authorizing a bonus of $30,000 for the Rideau Power Company, Limited.

North Cobalt, Ont.

The car barns of the Nipissing Central Railway, North Cobalt, Ont., were damaged by fire recently. Loss is estimated at $40,000 to barns, $60,000 to cars, and $30,000 to electrical equipment.

Penticton, B.C.

The electrical engineer of Penticton, B.C., Mr. F. L. McKeever, has submitted a report covering the extension of their generating plant by a 250 B.h.p. Diesel engine and direct coupled generator; also a new direct coupled generator for the 200 B.h.p. Diesel engine already operating in the power-house, the generator of which is belt-connected and of lower capacity. The total cost of equipment and installation is placed at $54,000.

St. John, N.B.

The St. John Railway Company, St. John, N.B., have sold out to a company as the New Brunswick Investment Company. The purchase price was $1,300,000. The former company did the entire street railway, electric light, power and gas business in the city of St. John, as well as controlling a transmission line from there to Rothesay, a distance of nine miles.

Swift Current, Sask.

City council of Swift Current, Sask., will shortly call tenders for a 615 h.p. oil engine for the electrical department.

Toronto, Ont.

The Ontario Railway and Municipal Board have ordered the Toronto Street Railway Company to build 200 new double truck cars, 100 to be ready January, 1918, and 100 January, 1919.

Alderman Ramsden, of the Toronto city council, is urging an expenditure of $5,000 for painting the numbers of houses on hydro-electric poles throughout the city.

A Toronto contractor was fined $35 for neglecting to secure a permit to install some electric wiring and for neglect to remedy defective workmanship when ordered to do so by the Hydro-Electric Inspection Department.

Welland, Ont.

The gross earnings of the Welland hydro-electric department for the year 1916 were $93,646.11; expenses were $80,686.97, leaving a surplus of $12,957.14.

Windsor, Ont.

The Canadian Steel Corporation, Windsor, Ont., have contracted for 2,000 h.p. of hydro-electric power. The effect of this, we understand, is an immediate reduction of the Windsor power rate from $39 to $31 per h.p.

Yorkton, Sask.

Tenders are being received by the town council of Yorkton, Sask., for a 357 h.p. oil engine, 280 kw. generator, and a transformer.

Contracts for Pumping Equipment

The Turbine Equipment Company, Limited, have received the following contracts for pumping equipment:—

From the town of Lindsay,—1 De Laval 2-stage pump, having a capacity of 1,250,000 Imperial gallons a day, for domestic requirements, and 1,750,000 Imperial gallons a day for fire requirements. A vertical high speed gasoline engine will be connected by clutch to one side of the pump, and the electric motor on the other.

From the town of Barrie.—1 De Laval single stage centrifugal pump, capacity 1,000,000 to 1,500,000 million Imperial gallons a day, to operate against 87 lbs. pressure and direct connected to 100 h.p. electric motor.

From International Nickle Company, Port Colborne, Ont. —1 De Laval 130 h.p. steam turbine-driven centrifugal Underwriter fire pump.

The Crouse-Hinds Company are distributing their bulletin No. 301, describing Imperial flood light projectors. The art of flood lighting, to bring out, during darkness, the daytime beauty of architecture, the commercial value of painted signs, etc., has become a well established branch of illuminating engineering. Flood lighting can be used effectively for building exteriors, statues, monuments, billboards, wall, chimney or other signs, flags, pageants, construction work and many other purposes. The use of flood light projectors for outside work will enable a contractor to operate a night shift effectively. Railroad yards, coal docks and piers may be lighted with these projectors and worked at daytime efficiency. Frequently motor fire trucks are equipped with them. The bulletin is well illustrated and contains a quantity of interesting information regarding projectors.

C. G. E. publications—Electric appliances for the home, pamphlet describing and illustrating C.G.E. household appliances; bulletin No. 48905A, arc welding apparatus; bulletin No. 46291A, portable test meters for alternating current circuits.

Electrical News
Generation, Transmission and Application of Electricity

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"Underground Cables" at the Local A.I.E.E.

On Friday, March 16, the Toronto section of othe A.I.E.E. was entertained by a lecture from Mr. H. W. Fisher, chief engineer of the Standard Underground Cable Company, on the subject of underground cables. Although Mr. Fisher is a recognized expert in the higher technology of this subject, he presented it in a semi-popular and quite informal manner. First, considering the raw materials—copper, rubber, paper, varnished cambric, and lead—the lecturer enumerated some of the tests which these materials have to fulfil in order to meet the manufacturers' requirements for cable-making. Methods of breaking down, bolting, and drawing the copper were described, with lantern views showing the mills at Perth Amboy in operation and illustrations of typical rolls and wire machines. After briefly describing stranding and stranders, Mr. Fisher turned to the matter of dielectrics, and explained the methods and appliances for rubber covering and for lapping the paper or varnished cambric around the cores. Lead presses of both the horizontal and vertical types were also briefly treated. In discussing joint boxes the lecturer particularly emphasized the necessity for using filling compounds of a consistency which would not become fluid at the working temperature of the cores. Samples and views of various forms of joint and terminal box were shown and further explained by Mr. Nolan, of the Standard Underground Company, and at the close of the lecture the members had the opportunity of looking over a very complete line of cable samples exhibited by Mr. Fisher.

As might be expected, the electric cable interests were well represented at the meeting, there being several members of the Standard Underground Cable Company from Hamilton, Mr. F. John Bell, with a number of the executive of the Canada Wire and Cable Company, and Mr. Walter F. Wright, of Eugene F. Phillips, Ltd.

The next meeting of the section, on April 4, will be a joint session with the Society of the Chemical Industry, and will be devoted to a discussion of "The Electric Furnace." At the meeting scheduled for April 20 a paper will be read by Mr. Ernest V. Pannell on "The Cost of Rapid Transit Systems.. At this meeting also the elections and other annual business of the section will take place.

Necessity for Greater Production

Mr. James S. Brierley addressed the members of the Montreal electrical luncheon on March 21 on the subject of the cultivation of land in the vicinity of Montreal with a view to the greater production of foodstuffs. He pointed out that there was a gap between the production and consumption of food, and that the public generally did not appreciate the potentiality of the danger which threatened by the shortage in food. The millions of fighting men withdrawn from the production of commodities had caused a world-wide scarcity, which would mean perilous conditions, especially for the wage-earners. The return of tens of thousands of men at the end of the war would aggravate the position, as these would not be able to find positions at once, and there would be a period of readjustment during which there was certain to be much unemployment. Low wages would follow, and, in addition, there would be a deficit in food, increasing the value of the different foodstuffs. Besides this, Germany, Austria, Italy, and France would probably divert food to their countries, so that on the one hand workmen in Canada would find their wages lowered and on the other hand prices would increase. To prepare for such conditions a central committee has been formed in Montreal to promote the cultivation of vacant land in the vicinity of the city. Mr. Brierley stated that success had attended similar efforts in other parts of Canada. He outlined the conditions under which lots of land will be granted to various people and the classes of food which should be grown. The committee were advised by practical farmers, and the speaker expressed the opinion that the movement was a national and patriotic one, capable of meeting to some degree the shortage of food. Some members of the luncheon volunteered to co-operate by assisting the committee.

The Inefficient, After the War

"The Position of the Inefficient After the War" was the subject of a talk by Mr. H. Hulatt, manager of telegraphs of the Grand Trunk Railway System, at the Montreal electrical luncheon on March 7. He was of opinion that great benefit would accrue as the result of the war, and that the British Empire would be greater, morally and commercially, as the outcome of the conflict. On the other hand, it would be many years before Germany recovered her status in the commercial world. England was even now taking the most aggressive measures, with a view of entering more largely into foreign markets, and was adopting American efficiency methods to this end. Canada would have to take the same measures, and must prepare for the inevitably severe competitive conditions which would exist. We must complete our machinery and also be prepared from the individual point of view. Were we to scrap the munitions plants, or to turn them to use in order to share in the world's trade. In his view, these matters were not being given the attention they merited.

What was to be the general condition after the war, and what was the position of the inefficient to be? In Western Canada, particularly, there was an acute labor problem, due to the drain of men who had gone to the front. A large number of men were, in consequence, occupying responsible positions for which they were not absolutely suited. At the expiration of the war thousands of men would return, and it was also likely that there would be a large amount of emigration. It was a fallacy to think that these men would go to the land. Many would want to go back to their old positions, and they would return to this country with their views broadened. In the speaker's opinion, very few of the employees had any initiative or desirer to train themselves for responsible positions which might arise. He urged the importance of corporations and firms encouraging their men to study—to think, to acquire knowledge outside the particular line in which they were engaged. One of the greatest means to secure this end was the get-together meetings, at which men could be impressed with the idea of educating themselves for higher positions.

Amendments to Telephone Act

The Ontario Telephone Act has been amended so as to make it a punishable offence for anyone to divulge any conversation not addressed to, or intended for, that particular person. Arrangement is also made for connection between Dominion and provincial companies. These topics fall under sections 11 and 13 of the amended act, and are worded as follows:

11.—(7b) Every operator or other person in the employ of a telephone company who divulges the purport or substance of any conversation or message except when lawfully authorized or directed so to do, is guilty of an offence, and shall, on summary conviction before a justice of the peace, be liable to a penalty not exceeding $25 or to imprisonment for a term not exceeding thirty days or to both penalty and imprisonment.

(7c) Every person who, acquiring knowledge of any conversation or message passing over the lines of a telephone system not addressed to or intended for such person, divulges the purport or substance of such conversation or message except when lawfully authorized or directed so to do, is guilty of an offence and shall, on summary conviction before a justice of the peace, be liable to a penalty not exceeding $25 or to imprisonment for a term not exceeding thirty days or to both penalty and imprisonment.

13.—(33a) Where the telephone system or lines of any company within the legislative jurisdiction of the Province of Ontario and the system or lines of any telephone company within the jurisdiction of the Parliament of Canada are situate in such proximity to one another as to make it practicable for such systems or lines to be so connected as to provide direct communication whenever required, between any telephone on the one system or line and any telephone on the other system or line, either of such companies or any municipal corporation or other public body or any person interested may file with the secretary of the board, and with the secretary of the Board of Railway Commissioners for Canada an application for an order that such connection should be made, together with evidence of service of such application upon the companies interested or affected, and the provisions of paragraphs b, c, d, and e of subsection 1 of section 131 of The Ontario Railway Act, with the necessary adaptation, shall apply to every such application.

The Hamilton, Ont., street railway earnings for 1916 totalled $706,739, compared with $569,694 in 1915. The city's share was $56,543, compared with $45,576 in 1915.

Industrial Value of Electricity

With the object of bringing into more prominence the developments in electric products, particularly in relation to other industries, the Canadian Pacific Railway Company, in co-operation with Arthur D. Little, Limited, organized an exhibit in the Shaughnessy Building, Montreal. The exhibit comprised a great variety of raw materials and finished articles, all illustrating the economic value of electrolytic processes and the products of the electric furnace. The materials were labelled and also accompanied by placards setting forth the classes to which they belonged, so that the layman could see at a glance the relation between the raw products and various finished goods. A large diagram of electro-products and their uses demonstrated the diversified and numerous processes and products, its object being to lead to a greater general appreciation of the work accomplished through scientific and industrial research, and point the way to the potentialities that exist in the water powers of Canada.

A map of the water powers of Canada indicated the widespread distribution of the powers at present commercially available, some 90 in number. The total power available and adjacent to the C.P.R. is 7,500,000; the total power adjacent to the C.P.R. is 750,000; estimated total power available in Canada, 17,746,000; total power developed in Canada, 1,700,000. By provinces: Nova Scotia, 21,412; New Brunswick, 13,390; Prince Edward Island, 500; Quebec, 520,000; Ontario, 789,460; Manitoba, 56,730; Saskatchewan, 45; Alberta, 33,305; British Columbia, 265,345; Yukon, 12,000. With such extensive water power at her disposal, Canada is exceptionally well equipped to develop those industries into which hydro-electric products enter, and the exhibition shows that we have already made considerable progress in this direction. The Shawinigan Water and Power Company, through its subsidiaries, have done much work, particularly in the matter of products necessary for war purposes.

The Electric Furnace

A number of photos included those of Snyder & Runnefelt electric furnaces, batteries of electrolytic cells, and battleplanes in which aluminium is used.

The various stages of the manufacture of Mazda electric lamps, and also specimens of the materials used, were shown, while materials for artificial abrasives, produced at Chippewa, Ont., and Niagara Falls, N.Y., were staged. The Canadian Electro Products Company, Ltd., Shawinigan Falls, P.Q., loaned a collection of their products. Electric steels in various forms, including a steel piercer made of alloy steel which has punched 24,000 4.5 shells, non-ferrous and ferrous alloys, and ferro sillicon were also shown. In this connection it was pointed out how largely the steel industry is dependent upon the products of the electric furnace in the matter of alloys. Ferro-sillicon is used in the production of open-hearth steel, and without it satisfactory steel could not be produced. Seventy per cent. of the steel in North America is made by the open-hearth process, and without ferro-silicon the entire steel industry on this continent would be crippled.

The annual report of the Joint Committee of Technical Organizations will be presented and discussed at a general meeting of technical men on Friday evening, March 30, in the Chemistry and Mining Building of the University of Toronto. Everyone who is associated in any capacity with engineering or technical work, whether himself a technical man or not, is earnestly requested to attend this meeting.

The Water Powers of Western Canada

Comprehensive Data on the Hydraulic Resources of Manitoba, Saskatchewan and Alberta Compiled by the Commission of Conservation— This Article, the Second of a Series, Deals with the Smaller Rivers of Manitoba

Whitemouth River

The Whitemouth River rises in Whitemouth Lake, in the southeasterly portion of Manitoba, and flows northerly to the point where it joins the Winnipeg River, just below the Upper Seven Sisters Rapids. The drainage area of the river is 1,566 square miles. The development of power on this river is possible at two sites:

Site No. 1.—Part of this descent could be concentrated at the fall at the mouth of the river and a head of 20 feet obtained.

Site No. 2.—About three miles below the town of Whitemouth a head of approximately 20 feet is obtainable, the high banks enabling successful development without flooding any considerable area of valuable land.

A minimum mean monthly flow of 45 second-feet for the open water season occurred in 1915. The estimated power, assuming an efficiency of 80 per cent., with this flow would be 82 h.p. at each of the two sites during the open-water season.

Red River

The Red River rises in the State of Minnesota. The drainage basin of the river includes an area of 116,347 square miles, of which 42,547 are in Minnesota and Dakota, 50,500 in Saskatchewan, and 23,300 in Manitoba. The drainage basin of its largest tributary, the Assiniboine, forms a considerable portion of this area.

In Manitoba the only feasible power development is situated at Lockport, where the construction of the dam at St. Andrew's Rapids has concentrated a head of approximately 15 feet. As the shutters of this dam are raised during the winter and during freshets, any development at this point would necessarily be for operation only during the period when the dam is held as an aid to navigation, usually between May and October. The estimated power available at this site, based on an 80 per cent. efficiency, assuming a head of 15 feet, and an estimated low flow of 2,000 second-feet would be 2,730 horse power. Calculated from the information at hand, the lowest mean monthly flow of the river where it enters the province, and of the tributaries entering in its course between Emerson and Lockport, is 2,000 second-feet. This discharge is estimated only for six months, ending October 31, 1913, 1914, and 1915, and is subject to revision.

Roseau River

The Roseau River is the largest tributary entering the Red from the east, in its course through Manitoba. It has its headwaters in the low lands lying to the west of Lake of the Woods. About half its total length lies south of the international boundary, and it joins the Red River approximately ten miles north of same. The general direction of the river is northwest, and its course is very tortuous. The drainage basin of the river includes an area of 1,987 square miles—1,097 in Minnesota and 8990 in Manitoba. No surveys for the purpose of locating power sites have been made on this river, and information as to the possibility of concentrating the natural fall at points throughout its course is very meagre. Local authority reports that, in the neighborhood of Dominion City, there is a possible development of 15-foot head, but this has not been investigated.

Pembina River

The Pembina River rises on the northeasterly slopes of Turtle Mountain and flows easterly to a point fifty miles above its mouth, where it turns southward, crossing the international boundary, then, turning again to the east, flows into the Red River about five miles south of Emerson.

There is no information available respecting any surveys having been made on the river for the purpose of locating water-power sites, but the nature of the valley and the natural fall of the river indicate the possibility of development. The descent of the river, from the base of Turtle Mountain to the point where the valley opens out into that of the Red River, is 700 feet, or approximately three feet per mile.

Assiniboine River

The Assiniboine River rises in Saskatchewan, on the southeasterly slopes of Nut Mountain, adjacent to the headwaters of the Red Deer River. Thence it flows southwesterly until it crosses the boundary between Saskatchewan and Manitoba, where it turns and flows southward until approximately in the latitude of Brandon; thence it flows easterly to its confluence with the Red River, in the city of Winnipeg.

Its drainage basin includes an area of 59,550 square miles. Of this area approximately 8,800 square miles lie in North Dakota, 37,700 in Saskatchewan, and 13,050 in Manitoba. Its principal tributaries are the Qu'Appelle, Souris, Shell, and Minnedosa (Little Saskatchewan).

There are no power developments on the river in Manitoba, the development at Millwood having been destroyed in the spring of 1913. A total head of 18 feet was obtained, and the power operated a flour mill. Three surveys of possible dam sites for the development of power for Brandon have been made on the river in the vicinity of the city. One of these was made in 1902 by the late Cecil B. Smith for the Western Electric Light and Power Company. The second was made by R. E. Speakman, city engineer of Brandon, for the purpose of investigating a proposition made to the city by the above-mentioned power company. During 1913 a reconnaissance by the Manitoba Hydrometric Survey was made, under the direction of the late G. H. Burnham, at Currie Landing, about 12 miles below Brandon. The results of these surveys show that, in the vicinity of Currie Landing a possible head of 18 feet is obtainable. This head would probably be diminished somewhat during high water.

Assuming a minimum mean monthly flow of 45 second-feet, 74 h.p. could be developed at Millwood with 80 per cent. efficiency under the 18 feet of head, while for the period of six months, from May to October, with an assumed flow of 118 second-feet, 193 h.p. would be possible. At the Currie Landing site a minimum mean monthly flow of 60 second-feet may be assumed, which, with an efficiency of 80 per cent. under a head of 18 feet, can produce 98 h.p. for the period of six months, May to October, an assumed flow of 180 second-feet would give 295 h.p. at this site.

Souris River

The Souris River rises in the southern portion of Saskatchewan, about 20 miles northwest of Weyburn. Between its confluence with the Assiniboine and the point where it first enters Manitoba it descends 305 feet, or about two feet per mile. The flow in the river is very irregular, and, as it sometimes goes down to nil during summer and winter, no definite estimates for power are given.

A power site, situated about one mile above Souris, Man., has been investigated by the Department of Public Works, Manitoba, in the interest of the town of Souris. A head of approximately 25 feet could be created by a dam constructed just above a rapid which has a fall of 14 feet. This site was first investigated in July, 1906, by Mr. K. S. Patrick, who found the flow at that time to be over 1,600 cubic feet per second, giving 1,300 theoretical horse power with 25-feet head. The same site was afterwards inspected by Mr. A. Livingston in the month of March for winter conditions. The flow was then found to be 100 cubic feet per second, giving 285 minimum theoretical horse power, with the 25-feet head. Mr. Livingston further states that from 600 to 800 horse power would be available for eight months in the year. Subsequent stream-flow observations show that the available power would be much less than Mr. Patrick's estimate.

Minnedosa River

The Minnedosa River (Little Saskatchewan) River rises in the southerly portion of Riding Mountain forest reserve. The data at hand show quite a variation in the flow of the river from year to year, but is not sufficient to allow of definite estimates for power. Should a regulated flow of 200 second-feet be feasible, which seems possible during certain years and portions of others, the following power would be available at the different sites, with an assumed efficiency of 80 per cent.:

	Feet of head.	Horse power.
Brandon Electric Light	30	545
Minnedosa Power Company ..	25	455
Dam site No. 1	40	730
Dam site No. 2	45	820
Dam site No. 3	47	860
Daw site No. 4	20	365

Birdtail Creek

At two or three power sites near Birtle low heads could be created by dams. One of these has been investigated by the Manitoba Public Work Department, on behalf of the town of Birtle. The report states that the site is situated one mile east of the town, where the river takes a wide sweep at the foot of a steep hill and, falling through a small rapid, divides into two streams, which reunite a short distance downstream. The north bank of the river is low for a distance of about 400 feet, beyond which it rises abruptly to a height of nearly 20 feet. The banks are of a sandy loam, containing numerous field stones. The dam can be constructed to give an effective head of 18 feet, which could be increased to 24 feet if required. The power is estimated at 250 h.p., available for nine months of the year.

One of the other possible sites is situated one-half mile below the town, and a third 15 miles northeast of the town. Both of these are at abandoned grist and sawmills. Each of them had between eight and ten feet head, but auxiliary steam plants were used.

Shell River

Shell river, one of the largest tributaries of the Assiniboine, rises in the northerly portion of Duck Mountain and empties into the Assiniboine, about three miles above the village of Shellmouth.

No survey work has been done on the river, but casual observations and available information indicate that, for power purposes, this stream is one of the best of the smaller rivers of the province. From the mouth of the river to the confluence of the east branch—approximately 75 miles—there is a difference in elevation of 600 feet, or 8 feet per mile. This fall is quite evenly distributed in the upper reaches, but is more marked in the lower portion of the river. This natural descent, combined with the high banks, indicates easy development at different points. The one development on the river at Assessippi has a head of 10 feet, and, though using only a small portion of the flow, developed 50 horse power. At no period of the year was trouble experienced from lack of flow.

Fairford and Dauphin Rivers

The Fairford and Dauphin Rivers form the connection between Lake Manitoba and Lake Winnipeg. Debouching near the extreme northeasterly portion of Lake Manitoba, the Fairford River flows northeasterly to Lake St. Martin. From the latter lake the Dauphin River flows due north for a distance of 14 miles; then, turning sharply to the east, it continues on this course to Sturgeon Bay, on the west shore of Lake Winnipeg.

An estimate of the power available is given in the following table. The power has been computed at 80 per cent. efficiency on an estimated low flow of 3,400 second-feet, no estimate having been made respecting the additional power available through storage: -

Power site.	Head in ft.	Est. h.p. at 80 p.c. efficiency; low flow of 3,400 sec.-ft.
No. 1	8	2,500
No. 2	6.5	2,000
No. 3	28	8,700
No. 4	16	5,000
Total horse power		18,200

Waterhen River

The Waterhen River flows out of the southerly portion of Lake Winnipegosis and discharges into the north end of Lake Manitoba. Issuing from Long Reach of Lake Winnipegosis, it flows in a northerly direction, a distance of some eight miles, to Waterhen Lake; thence 18 miles in a southerly direction to Lake Manitoba.

The power possibilities in the Waterhen River itself do not offer any very attractive features, but its waters can be diverted across the narrow neck of land separating Lake Winnipegosis from Lake Manitoba. At various times the construction of a canal between the two lakes has been advocated for navigation purposes, and, were this undertaking proceeded with, the development of power in conjunction with the canal would be an important factor.

A low flow of 3,000 second-feet has been assumed for the Waterhen River. This, together with an approximate head of 15 feet (both figures are subject to revision), would, on a basis of 80 per cent. efficiency, show a power possibility of 4,080 horse power.

Mossy River

Mossy River is approximately 21 miles in length, and discharges into the southerly end of Lake Winnipegosis. Discharge measurements taken during 1913, 1914, and 1915 show a minimum mean monthly flow of 65 second-feet. Two falls of 10 ft. each thus offer a development of 60 h.p.

Valley River

The Valley River—so called because because it flows in the valley between the Riding and Duck Mountains—rises in Singoosh Lake, in the northerly portion of the Duck Mountains. As there was no flow in the river during certain winter months of 1914 and 1915, the estimated power, based on 80 per cent. efficiency, has been computed for a low open-water season flow of 10 second-feet. Under these conditions, sites No. 1 and No. 2 would each give 17 horse power under 19 feet of head; No. 3 would give 50 horse power under 56 feet of head, while 47 horse power would be available at No. 4 under a head of 52 feet.

Swan River

The Swan River, situated in Central Western Manitoba, rises to the west of the Porcupine Mountain and flows in a

Manigotagan River—Wood Fall

Pigeon River—Peacock Rapid

Manigotagan River—Rapid below Cascade Portage

Berens River—Sandisland Chute

southerly direction for 50 miles. No field survey has as yet been made of its power possibilities, though it is known that considerable descent occurs throughout its course. At the mouth of Snake Creek, some 18 miles west of the Manitoba boundary, the elevation of the river bed, as obtained from preliminary lines of the Canadian Pacific Railway, is 1,390 feet above sea level, while Swan Lake is at an elevation of 849 feet. This would indicate a fall of 541 feet in an approximate distance of 100 miles. During certain winter months of 1915 there was no flow in the river, but it is estimated that about 25 second-feet would be available during the open-water season. Assuming an efficiency of 80 per cent., this flow would represent 23 horse power for every 10 feet of head.

Red Deer River

The Red Deer River rises in Township 44, Range 19, west of the second meridian, some 15 miles south of Melfort, Sask. It flows in an easterly direction, to Red Deer Lake—area, 100 square miles—and thence into Lake Winnipegosis. While field investigations of the power possibilities of the river have not been made, if a minimum mean monthly flow of 80 second-feet is assumed for the period from April to October, every 10 feet of head would represent 73 horse power, based on 80 per cent. efficiency. No winter estimates are given, as at times the flow dwindles to nil.

Manigotagan River

The Manigotagan River discharges into Lake Winnipeg, on the east shore, about 50 miles north of Fort Alexander, and almost directly opposite the centre of Big Island. The following tabulation shows possible power concentrations, under conditions of minimum flow and under regulated flow, based on the records of 1913, and gives the power at 80 per. cent. efficiency:

No.	Name.	Head.	Est. h.p., 80 p.c. efficiency. Min flow.	Reg. flow.
1	—Wood Fall	33	90	449
2	—Poplar Fall	8	22	109
3	—First rapid above Poplar Fall	12	33	163
4	—Fourth rapid above Poplar Fall	30	82	408
5	—Third rapid above Cascade portage	12	33	165
6	—Sixth rapid above	18	49	245
7	—Charles Fall	34	92	462
8	—Turtle Cascade	28	76	381
9	—Second rapid above	21	57	286
10	—Carobou Fall	27	74	368
	Total horse power		608	3,034

Pigeon River

Pigeon River flows into Lake Winnipeg in a deep channel, a hundred yards wide. It has numerous concentrated falls or rapids; the descend in each, however, is not great. The greatest descent on the river is 29 feet, at Shining Fall. There are four rapids or falls with descents between 10 and 15 feet, fourteen with descents between 5 to 10 feet, and numerous others with descents of less than 5 feet. Many of the falls and rapids on this river can be combined to obtain workable heads. The discharge, metered by Mr. Leo G. Denis, at a point three-quarters of a mile below "First" rapid, was 2,629 second-feet on September 19, 1913. A record obtained by the Manitoba Hydrometric Survey on March 5, 1915, gave a flow of 1,164 second feet

Berens River

The mouth of Berens River is nearly halfway up Loke Winnipeg, on its eastern side. There are numerous concentrated falls or rapids, but the descent in each is not very great. The greatest is at Nightowl Rapid, which has a descent of 39 feet. Little Grand Rapid has a descent of 21 2 feet. There are six rapids with descents of between 10 and 15 feet, ten with descents of between 5 and 10 feet, and numerous others with descents of less than 5 feet. Many of these could be combined to obtain a head of water which it would be profitable to develop. Between the chutes there is little or no current. The discharge of the Berens, metered by Mr. Leo G. Denis at a point two miles above "First" Rapid, was 1,744 second-feet on September 10, 1913. The discharge of the Etomami, a small river parallelling the Berens and emptying into it, was 234 second-feet at a point just above its mouth, on September 9, 1913. A record obtained by the Manitoba Hydrometric Survey on March 2, 1915, gave a discharge of 634 second-feet for Berens River.

Poplar River

The Poplar River flows into an inlet on the east shore of Lake Winnipeg, about midway between the north and south extremities of the upper main body of the lake. The power possibilities of this river have not been fully investigated, but it is stated that several rapids occur, the more important being in the reach of the river below Thunder Lake. An estimate of the mean annual discharge of the river, based on a run-off of 0.3 second-feet per square mile would give a discharge of 585 second-feet.

Big Black River

The Big Black River discharges into an inlet on the east shore of Lake Winnipeg, about 40 miles from the northerly extremity of the lake. Situated as this river is, in a portion of Manitoba which is unsurveyed and difficult of access, little is known as to the ertent of the descent occurring on this river, but it is known that there are rapids at several points.

Belanger River

The Belanger River discharges into Lake Winnipeg, on its eastern shore, about 20 miles from the north end of the lake. It rises in the vicinity of Gunisao Lake and flows in a westerly direction to Lake Winnipeg. Investigations of the power possibilities of this river have not been made, but it is known that considerable descent occurs, and that it is concentrated at several points, indicating power possibilities. At the first rapids above the mouth a fall of about eight feet is reported, while above this there are many rapids which are impossible to navigate and necessitate portages.

In the Lake Winnipeg basin there are also the following rivers:

Etaomami River practically parellels Berens River, flowing into the latter a few miles above Lake Winnipeg. The total estimated fall in the river is 180 feet; two of the rapids have descents of 8 feet and 15 feet respectively.

Gunisao River has two important rapids below its forks; the North branch has 10 portages, while there are 22 on the South branch.

The Electric Club of Toronto

The April program of addresses before The Electric Club of Toronto at their Friday noon lunches has been arranged as below. As April 6 is Good Friday, there will be no meeting on that date:

April 13—Mr. Geo. Baldwin—Vegetable Gardening. This address will be illustrated with lantern slides and blackboard drawings. Mr. Baldwin is said to be the most successful amateur back-yard gardener in the city.

April 20—Mr. A. E. S. Smythe, Toronto "World"—The Angels of Mons.

April 27—Dr. C. J. Hastings, M.O.H., Toronto Public Health a National Problem

National Organization for War[†]

By Stephen Leacock.

The truth is that in all these things individual greed and selfishness obscure the issue. War brings with it the peculiar phenomenon of war prosperity. This, economically, is one of the most distressing things conceivable. Here is the interpretation of it: It is as if an industrious farmer and his family had worked hard for a generation and amassed flocks and herds, barns and buildings, and good stores of provisions and grain; then, in a moment of insanity, had set to work to burn the buildings, and in the warm light of the flames, kill and devour the animals, and gorge themselves with the grain and fodder, throwing the rest away. In this mad orgy one son of the family, more idiotic even than the rest, rubs his silly hands before the burning home, and leers: "Father, it is warmer here and nicer, and there is more to eat than in the old days, when we worked hard and had but little food. Father, we are prosperous. We have done a good thing." Then presently the fire burns down into ashes and the night comes and the dark. And where the grain once stood and the meadows smiled in the sun the wolves shall howl again in the gloom of the forest. And where the homestead was there will be graves. Such is the interpretation of war.

The farmer and the family are the nation, and the idiotic son laughing beside the fire is the war theorist talking of the boom of trade.

Patriotic Hypocrisy

But people either do not, or will not, know this. They still want their industry and its inflated gains, and was prosperity with the flush on its hectic face, and war pleasure with its strident laugh, dancing away the midnight hours. In and through it all moves smug hypocrisy, suggesting the little words and phrases that are to salve the soul; teaching the manufacturer to call himself a patriot as he pockets his private gains, and to shout for trade, more trade, that he may cram his pockets the fuller; teaching the farmer that his own fat, easy industry is war itself, and that he may count his fatted cattle in the light of his stable lantern and go to bed a patriot; teaching all the drones and parasites, the lawyers, the professors, the chefs and the piano players, the actors and the buffoons, that in going on with their business they are aiding in the conduct of the war.

"Business as usual!" shouted some especial idiot at the outset of the war.

The cry was like to ruin us.

What, then, are we to do By what means can we change from an economy of peace and industrial selfishness to an economy of effort and national sacrifice?

There are two ways in which this can be done; one that is heroic and impossible, another that lies easy to our hand.

The first is the method that nations adopt only in their despair, only in the last agonies of foreign conquest, as when Richmond fell, or when the Boers fought on in grim desperation across the naked veldt. Here national production ends, save only for necessary food and war supplies. Private industry is gone. Luxury is dead. All of the nations men are gathered into a single band. They do as they are told. They fight, they work, they die. Its women are in the fields, or they are making bandages; they tend the sick; they pray beside the dying.

Thus can a nation stand, grim and terrible, its back against the wall, till it goes down, all in one heap, glorious. In the wild onslaughts of the great conquests of the past, nations have died like this.

But for us, here and now, and in the short time that we have, this is not possible. Outside invasion could force us to it, in a jumbled wreck, with no choice of our own. But to accomplish this at a word of command inside our present complex industrial system is not possible. It is too intricate, too complicated, to be done by command from above. To enlist every man and woman in an industrial army, to direct their work and assign their rations—in other words, to create an ideal national war machine—is a task beyond the power of a government. Years of preparation would be needed.

National Organization

What we do must be done from below, using, as best we can, the only driving force that we know—the will of the individual. We must find a means that will begin to twist and distort our national industry out of its present shape till it begins to take on the form of national organization for war.

To do this we must exchange war prosperity for war adversity, self-imposed and in deadly earnest.

The key to the situation, as far as we can unlock it, lies in individual thrift and individual sacrifice. Let there be no more luxuries, no wasted work, no drones to keep, out of the national production.

Every man to-day who consumes any article or employs any service not absolutely necessary aims a blow at his country.

Save every cent. Live plainly. Do without everything. Rise early, work hard, and content yourself with a bare living. The man who does this—if he uses the saved money properly—is doing war work for his country. He may wrap his last year's coat about him and eat his bread and cheese, and feel that he, too, is doing something to show the world the kind of stuff that is yet left in it.

[†] Extracts from pamphlet distributed by the National Service Board of Canada.

But he must use his savings properly. That is the whole essence of the matter.

Limit Buying to Necessities

Let us see what this implies. If the idea of national thrift were really to spread among us, there would be no more purchases of mere luxuries or things that could be done without—no more motors, no theatres (save where the work is voluntary and the money for the war), no new clothes (they would become a badge of shame), no books, no pictures, no new furniture, no new carpets, no victrolas, and for our children no new toys save such as can be made by the affectionate industry of a father working overtime with bits of stick and cardboard.

Such a programme would threaten to wipe out manufacturers and knock down dividends like ninepins. At first sight, a manufacturer, reading such an article as this, turns pale with indignation and contempt. Let him wait. Let us follow the money that is saved a little further and see what happens to it.

Every cent of the money that can be gathered up by national thrift should be absorbed by national taxes and national loans. Our present taxes are, for war time, ridiculously low as far as all people of comfortable, or even of decent, means are concerned. And they are made with one eye on the supposed benefit to industry. We need a blast of taxation—real taxation, income tax and all—that should strike us like a wave of German gas. As things are, we should go down before it. Armed with the new gas helmet of natonal thrift, we could breathe it easily enough and laugh behind our goggles.

Government Bonds

Over above the taxes we need a succession of government patriotic loans, not money-lenders' loans at market and super-market rates, but patriotic loans in the real sense, at a low rate of interest, let us say, 4 per cent., and issued in bonds of $25, with a dollar a year as interest.

The people, one says, will not subscribe. Then, if not, let us perish; we do not deserve to win the war.

But they will subscribe.

If, under the auspices of our government, a national campaign for thrift and investment is set on foot; if we give to the ideas all the publicity that our business brains can devise; if we advertise it as commerce advertises its healing oils and fit-right boots and its Aphrodite corsets, then people will subscribe, tumultuously, roaringly, overwhelmingly.

If not—if that is the kind of nation that we are—let us call our soldiers home from the western front. They are fighting under a misunderstanding. The homes that they are saving are not worth the sacrifice.

But first let the government—of the dominions, the provinces, the cities, and the towns—itself begin the campaign of thrift. At present vast sums of money are being wasted in so-called public works—railways in the wilderness, cement sidewalks in the streets, post-offices in the towns—millions and millions that drain away our economic strength. In time of peace these are excellent. For war, unless they have a war purpose, the things are worse than useless. The work of the men who labor at them is of no value, and the food and clothes that they consume must be made by other men.

Let us be done with new streets and new sidewalks, new town halls, and new railways till the war is done. Let us walk in our old boots on the old boards, patriots all, with dollar pieces jingling in our pockets adding up to twenty-five for the latest patriotic loan.

Let us do this, and there will pour into the hands of the government such a cascade of money that the sound of it shall be heard all the way to Potsdam.

What Can You Make?

And here enters the last step to be taken under natoinal thrift to convert ourselves into a war economy. The government goes with its money to the manufacturers and interrogates them. What can you make, and you, and you? You have a plant that has made buggies and fancy carriages. These our people will not buy because now they walk. But what is it that you make? Can you turn yourself to making trucks, wagons? You, that made boots and have lost half your trade, what about a hundred thousand boots for the army? You, that made clothes, what about doing the whole thing over in khaki?

The needs of a war government are boundless, endless. The list of its wants is as wide as the whole range of our manufactures. The adjustment is difficult. Not a doubt of it. It cannot be done in a day. But with each successive month the process would go on and on till we would find ourselves, while working apparently each for himself, altered into a nation of war-workers, every man, in his humble sense, at the front and taking his part.

Meantime, we at home are doing nothing, or next to it, for the war. While we go about our business as usual, men are breathing out their lives for us, somewhere in France.

What shall we do?

Electro-Chemical and Metallurgical Possibilities in Canada

By H. E. Howe*

In considering the utility of hydro-electric power, we must remember that it is simply another way of selling energy, and its cost must always be compared with the cost of energy in other forms, such as coal. It may be expected, therefore, that hydro-electric development will be more extensive in the immediate future in Canada than in the United States, for example, where coal is found relatively near the industrial centres and at points where it can be used direct, or where gas from by-product coke ovens can be used to produce electric energy at a price competing with its cost when generated by hydro-electric power. It must be borne in mind that while steam plants are now producing power with approximately one-half the coal required fifteen years ago, and at a capital cost of little less than half what it was at that time, hydro-electric equipment had a very high initial efficiency, and consequently has not enjoyed anything like the same degree of improvement, while the cost has in no way decreased. In fact, owing to increased prices of materials and labor, the cost per horse power is probably higher than it was fifteen years ago.

Therefore, the fact that a water power exists and offers opportunity for development as a source of electric energy does not necessarily imply that it is economical to develop it or that developed, a group of industries will at once find a home in that vicinity.

Must Be Demand for Products

Let us consider for a moment whether electro-metallurgical and electro-chemical industries are in order for Canada at the present time. Two things enter into this consideration—first, is there sufficient demand for the products of these industries; and, second, are there not other demands for electric power which at present must supersede such industries? Almost without exception electric products are the raw materials for other industries; we must have a relatively large number of such industries before the establishment of electro industries can be justified. As to the second point, it would seem that a market for labor is one of the commanding questions before Canada at the present time, especially in view of the return of soldiers and the expected immigration of many hands, who will want employment in other than agricultural pursuits.

Other industries, such as spinning and weaving, employ many more hands per horse power of electric energy consumed than do electro-chemical and metallurgical plants, and can afford to pay a higher price. Such employment, in turn, builds up communities and offers opportunities for wholesale and retail merchants and the host of secondary industries incident to any concentrated population. If we consider the relation between the horse power consumed in Niagara Falls, N.Y., or Ontario, in relation to the population of these places and apply the same line of reasoning to the locality of Manchester, N.H., or Lowell, Mass., this point will at once be emphasized. It must be obvious that electro-chemical and electro-metallurgical industries face another handicap, for with the building up of the consuming population and industries utilizing electro products there comes a growing and insistent demand for power, which tends to place the cost of electric energy at a higher price than such processes can afford to pay. They are, therefore, gradually forced to seek advantageous points at a little distance from the large centres, but these points can only be chosen where the reasonably low incoming and outgoing freight rates are available.

Let us consider some of the points determining the location of electro industries.

Factors Determining Location

First, there must be a source of large blocks of power. The fixation of atmospheric nitrogen, for example, requires 25,000 kilowatt hours to produce one ton of 100 per cent. nitric acid. The manufacture of aluminum requires a like amount of power per ton of finished product. The production of ferro-alloys which have become an essential in modern industry for the making of high speed steels, the hardening of armor and piercing projectiles, consume from 3,000 to 8,000 kilowatt hour per ton of product, depending upon the grade of alloy made. The process of casting an alloy or refining steel consumes from 600 to 1,000 kilowatt hours per ton, while the refining of nickel requires energy to the extent of 3,000 kilowatt hours per ton. Lead is the smallest power consumer, since only 120 kilowatt hours per ton of refined product are required, while copper at 300 kilowatt hours per ton is next. It is evident, therefore, that different industries require blocks of power from 5,000 to 50,000 kilowatt hours.

Second, this power must be reliable. It should not be subject to great variation, for in electric furnace operations, especially, it is frequently fatal to have a sudden diminution in the amount of power available. This means that in some instances a water power which is subject to severe ice conditions or where the flow of water materially decreases in summer must have a steam plant as an auxiliary if a high average of efficiency is to be derived from the water power itself during other seasons of the year.

Cheap Power Necessary

Third, the power must be cheap, far cheaper than many suppose, if electro-chemical and metallurgical processes are to be established on anything approaching a large scale. Twenty dollars per horse power year, which is equivalent to 3c per kilowatt hour, is not cheap. Many important processes cannot live at that price. By locating a plant equipped with modern turbo-alternators near the coal fields it is possible to meet this figure through the generation of electricity from steam power. Artificial fertilizers and the great group of industries depending upon nitrates must have power considerably below $10 per horse power year. Dr. Eyde stated in 1912 that when electric energy in Norway exceeded a price of $6 per horse power it would become impossible for the great plants, so favorably located, to compete with other sources of nitrates.

Fourth, there must be reasonably cheap freight rates from the plant to the consuming industries and on the raw materials which must be brought in. Electro-chemical industries are large consumers of such materials as salt, coal, silica and calcium compounds, and in many instances their products must be sold at a price which precludes the possibility of paying large amounts for freight.

Transportation an Important Item

Fifth, for this reason the nearness to consumers is almost always an essential. It has been estimated that a distance of 1,000 miles to the centre of distribution is equivalent to an increase of from $10 to $20 per horse power year in the cost of power itself. Where raw materials are bulky and the product is not bulky, work must be carried on near the raw materials. Where large amounts of power are essential it may pay to bring the raw materials to it. Such questions must be separately considered in each individual instance.

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* Assistant to the president, Arthur D. Little Company, before Canadian Mining Institute, March 7.

Sixth, there must be good labor conditions; and, finally, raw materials must be available.

Relatively higher prices can be paid for electric power only where the most favorable conditions of locality, market, freight rates, accessibility to raw materials and labor conditions exist. An exceptional advantage for any one of these five factors may be sufficient to overcome a considerable weakness in one or more of the others. For example, in Norway power is so cheap and a large market so near, with water transportation, that a very large carbide plant is being installed, even though some of the raw materials must eventually come from a considerable distance. Niagara Falls is a most unusual locality, and, because of its exceptional advantages, must not be taken as a criterion for possible developments in other places as they exist at present.

Satisfactory Conditions Essential

It would seem, therefore, that while Canada's hydro-electric power offers many potential opportunities, it must be considered at present a reserve, and several conditions must be satisfactory before definite recommendations can be made. First, we must know more about Canadian natural resources that lend themselves to the treatment of electric processes, and we must have information in more available form than at present; second, the selection and establishment of an industry utilizing electric energy must be done with great care and with a thorough study of the economics in each instance; third, there must be a larger consuming population in Canada before the introduction of many of the electric industries can be justified; fourth, there must be more industries using electric products as their raw materials; and, fifth, really cheap power must be available.

To bring about this latter condition there must be lower costs for development. Many of the great power companies have been obliged to spend considerable money and embellishment, owing to the location of their power plants, which has added much to the cost per horse power. Owing to several uncertainties, money used in development has had to pay a higher interest rate than in other forms of industrial activity, and, besides, it costs nearly three times as much to develop a water power as it does to construct a steam plant to produce the same amount of kilowatts per hour. If capitalists would accept bonds at 5 per cent. instead of 7 per cent. the cost of production of a horse power hour would be reduced 22 per cent. Railways and other forms of industries seem to have no difficulty in obtaining money at this rate, and it may eventually become necessary for governments to use their credit to obtain money at low rates to assist in water power development. There must also be reasonable and co-operative legislation to insure the permanency and safety of private investments in such projects.

Electro-metallurgical Field

Based on these principles, the immediate future seems to offer Canada two fields for the utilization of hydro-electric power in electro-metallurgy and electro-chemistry. Perhaps the most important is the electro-metallurgical field. Here Canada has the raw materials; she has the consuming market for much of the material to be used in the construction work which must go forward, while in many instances the products can be exported to advantage by all water routes. Hydro-electric power would seem particularly well adapted to this industry here, because electric furnaces do not require the peculiar crucible clays which would have to be imported; the product is of the highest grade, and the fuel which we should feel called upon to conserve for the sake of posterity is replaceable with electric energy in the form of heat. Every million kilowatts used is equal to eleven and a half million tons of coal per annum, and it must be remembered that under the most favorable conditions it requires four pounds of coal to develop one horse power. Electro-metallurgic processes have already a strong foothold in Canada, and important developments have been the result. I refer to the production of ferro-titanium directly from the ores and, concurrently with it, the manufacture of high-grade irons from the titaniferrous iron ores of Canada, which have constituted a problem. You are also aware of the important place which electro-metallurgy holds with relation to munition manufacture. The indications, therefore, seem to be that further development, not only in the smelting of ores but in the utilization of scrap materials, lies in the immediate future.

Developments in Electro-chemical Field

In the electro-chemical field there are also instances of important developments, such as the group of processes at Shawinigan and at Niagara Falls, Ont. The production of nitrates now illustrated by the American Cyanamid Company at Niagara Falls, Ont., would seem to offer the best electro-chemical field, but it must have far cheaper power than is now offered if considerable expansion is to be expected. The production of nitrogen fixation is of great economic and national importance. Nitric acid is the basis of many chemical industries, is an absolute essential in all explosive manufacture, and is required in ever-increasing amounts for the production of fertilizers. Canada must eventually use fertilizer. It is well known that we cannot continually draw money from the bank without occasionally depositing funds, and yet we hear stories of how rich the farm lands used to be, forgetting that the fertility of a virgin soil must gradually disappear unless replaced in some measure. Those nations praised for the yields per acre are also the nations where the greatest amounts of fertilizer are used annually per acre. The fixation of atmospheric nitrogen is a large consumer of power; the product will stand reasonable transportation charges; a nation cannot be wholly independent without nitrates, and for these reasons this particular electro-chemical process would seem to command early attention.

Although it is beyond the province of this discussion, the utilization of hydro-electric power to a greater extent in transportation may be mentioned. The heavy initial investment is a serious factor, but against this may be mentioned the conservation of fuel, the fact that many water powers exist where grades are heavy and population sparse, and the fact that considerably greater motive power can be obtained from an electric locomotive than it is possible to develop from the most modern steam locomotives.

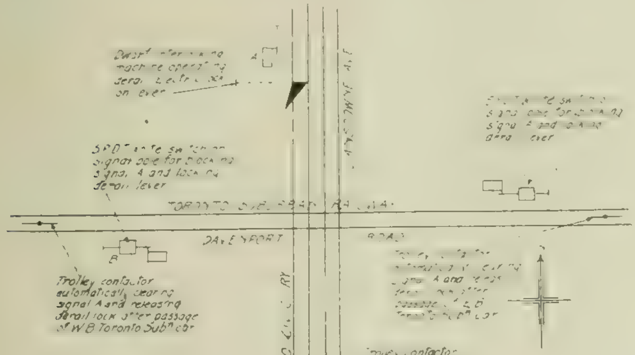
In considering the possibility of saving coal through the utilization of hydro-electric power it is interesting to note that prior to the war France consumed about 60,000,000 tons of coal per year, of which 33 1/3 per cent. was imported. Now the Germans hold a good part of the French mines, and it is needless to say that when they are returned to France they will be well worked out. Consequently a survey of the water power resources of France has been made, with the result that power estimated at from 6,000,000 to 10,000,000 horse power has been located. About 45,000,000 tons of coal are used annually in France for power, producing 12,000,000 horse power. The development of 6,000,000 hydro-electric horse power will represent an annual saving of over 20,000,000 tons of coal.

The cheapness of electric power determines to a great degree the future of electro-chemistry and electro-metallurgy in Canada, as well as elsewhere. I have attempted to set forth some of the limitations governing present processes, but with cheaper power it is not at all unlikely that new processes will be devised and new products be produced that may entirely alter the situation as it appears at present. Cheap power will also largely determine what can be done with existing processes.

Signal System for Toronto Municipal Railway

The General Railway Signal Company of Canada, Limited, of Lachine, P.Q., installed during the past year a signal system for the Toronto Civic Railway at the grade crossing of the Toronto Suburban Railway with the Toronto Civic Railway, Lansdowne Avenue and Davenport Road, Toronto. The Toronto Civic Railway approaches the Toronto Suburban Railway on a considerable grade from the north, and at the same time motormen have no view of an approaching car on either line until within fifteen or twenty feet from the crossing. The signal system was designed to protect movements on the down-grade track only of the Toronto Civic Railway against movements in either direction on the Toronto Suburban Railway. The plans herewith show the protection afforded.

A tongue type trolley derail was installed in the down-grade southbound track of the Toronto Civic Railway, operated mechanically from a dwarf interlocking machine, located between property line and sidewalk. Connection from the derail lever to the derail is made with 1 in. pipe enclosed in 2 in. galvanized pipe run underground between the machine and derail. The 2 in. pipe is filled with non-freezing oil and equipped at the ends with stuffing boxes. The normal position of the derail is open, making it necessary for a conductor on the civic railway car to leave his car and close the derail before proceeding over the diamond. An electric lock on the derail lever prevents the closing of the derail should a Toronto suburban car be within the limits between signals B and C. In closing the derail for a Toronto civic car the controls for signals B and C on the Toronto Suburban Railway are broken, causing them to go to the stop position. They remain in the stop position until the Toronto civic car has reached the trolley contactor on the southbound track approximately 100 feet beyond the crossing. The passing of the trolley under the contactor automatically restores signals B and C on the Toronto Suburban Railway to the clear position.


A
B
TORONTO SUBURBAN RAILWAY
DAVENPORT ROAD
TORONTO CIVIC RY
Trolley contactor automatically clearing signal A and releasing derail lock after passage of W B Toronto Sub'n car
Trolley contactor automatically clearing signals B&C after south bound move on Toronto Civic Ry

The conductor of an east or westbound Toronto suburban car upon approaching signals B or C and finding them in the clear position, changes the position of a single-pole double-throw knife switch, one of which is located at each signal, and in so doing sets signal A on the Toronto Civic Railway to the stop position and at the same time electrically locks up the derail lever on the southboound Toronto civic track, preventing the closing of the derail. The east or westbound car then proceeds across the diamond, and upon passing under trolley contactor approximately 100 feet beyond the crossing automatically clears signal A on the Toronto Civic Railway and releases electric lock on derail lever, allowing a southbound civic railway movement to be made.

The clearing up of opposing signals is entirely automatic, it being unnecessary for the conductors of either line to reset the system ofter passing over the diamond. Emergency switches have been provided to release the signals on either line should a car, after passing a clear signal, be stalled before automatically releasing the signals on the opposing line.

All of the signals are electrically operated General Railway Signal Company's model 2-A low voltage top post mechanisms. Relays are of the neutral type Model 9, Form A-4. Power for the operation of signals and relays is obtained from primary cells. The automatic resetting of signals is accomplished by the use of trolley contactors, arranged so that power from the trolley wire is utilized to momentarily pick up the signal control relays. After having been picked up they hold up from the primary battery. Suitable resistance is inserted between trolley wire and relay to obtain the proper potential for operation of relays.

Fair Weather Service Only

When we think about the jitney competition, we have to view the present effects along with the more remote, yet more important effects. It may be pleasant to be able to jump into a jitney when one is in a hurry, especially when there is a street car to fall back upon in snowy weather. But that is only a near effect.

The more remote effects are far more important. The unfair competition of the jitney with the street railway which furnishes transportation to seven-eighths of the travelling public of Vancouver and more, is bound sooner or later to affect injuriously the service that majority receives.

There can be no doubt of that. The jitney takes away the paying traffic, leaving the non-paying traffic to the street car. It runs in the good weather, leaving the clearing of streets to the street railway.

The jitney is now objecting to the regulations requiring it to run from end to end of the city—the only provision that is nearly on a par with the street railway's obligation to give transfers—and it is a poor substitute.

It is much more important that the public at large should have more and better street car service than that a few people should be singled out to get an occasional quick ride in a jitney.—B. C. Buzzer.

New Cars for Montreal Tramways

One hundred steel cars have been ordered by the Montreal Tramways Company, at a cost of $1,250,000. The cars will be operated in units of two, the leading car being equipped with four 55 h.p. motors and the trailer with two 55 h.p. motors, both under the control of one motorman. It is intended to use the cars on all the cross-town lines. The cars will have a seating capacity of 42 and the trailer of 45. The length of the body is 32 ft. 3 in. and over all 45 ft.; the width of body 8 ft. 5 in. The weight of the car without load will be 43,600 pounds, and that of the trailer 27,400 pounds, a total of 71,000 pounds. Automatic air brakes will be fitted, while the doors at the rear platform will be air-operated. The steps are to be of the folding type and the control electro-pneumatic-automatic. All the automatic features are to be operated from storage batteries, so as to ensure normal operation should the power be off or the trolley leave the wire. A new system of lighting will be installed, giving better illumination, and electric heaters will be provided. The truck design is also improved, with the object of making riding more smooth than at present.

The Dealer and Contractor

Wire-Your-Home-Time — One and a Half Million Canadian Homes Without the Means of Using Electric Service of Any Kind—A Ripe Harvest Awaits the Electrical Contractor

The Society for Electrical Development have practically completed their arrangements for their "wire-your-home-time" campaign, which is to extend from April 1 to May 15, and cover the United States territory thoroughly. Whatever may be said of the choice of date of such a campaign, there can be no doubt of its general value to the electrical industry. The society have calculated that there are some twenty million homes in the United States and that three-quarters of them have no electric service. If this proportion holds for our Canadian population, we have two million homes, one and a half million of which have no electric light or electric domestic devices in them. This means a big field, yet untouched, alike for the contractor, the dealer, the jobber, the manufacturer, and the central station. Think of the demand for lamps, irons, toasters, percolators, et al., if all these houses were wired up!

We wonder if the significance of this situation is sufficiently appreciated by the electrical trade. Particularly we question if it is realized that much of this flood of business is held back, not through disinclination on the part of the householder to use electricity, but through inability on account of his premises not being wired.

Briefly stated, the electrical demands of three-quarters of the homes of Canada **wait for the contractor.**

Think of it! Six millions of Canadian people who, in the nature of things, appreciate the value of electric service but can't get it. They are literally "dressed up and no where to go." Why? **Because the contractor has never wired their homes.** Why hasn't he? Well, just because these householders have never gone out and taken him by the collar and made him do the job. This may be putting it too strongly, some contractor says. But is it?

How many people have you, as a contractor, actually canvassed, vigorously and intelligently in the last year, and failed to convince? Do you know your own district thoroughly? Do you know how many homes within a half-mile radius of your place of business are without electric service? You are waiting for them to come to you, and they are waiting for you to go to them.

Do you realize, electrical contractor, what amount of business this all represents in possibilities. Suppose the average wiring job nets you $50. A million and a half times this amount means seventy-five million dollars of business waiting to be gathered up by somebody.

Then there is an iron for each of these homes, a toaster, an electric heater, and so on—another fifty dollars, and there are another seventy-five million for the manufacturer, jobber and dealer.

And, last, there is the central station, say, twenty dollars per year for current in each of these homes—thirty million dollars for the central station.

This totes up to the tidy sum of one hundred and eighty millions, and all this business waits for the electrical contractor to move.

Wouldn't it be a worth-while idiea to have a wire-your-home campaign right here in Canada?

Toy Electric Ranges Used by Aggressive Company to Bring in Grown-up Business

During America's Electrical Week the Texas Power & Light Company, Dallas, Tex., conducted, in 16 of the districts where it operates electric light properties, essay contests among the school children, offering as prizes 16 Western Electric Junior electric ranges. The decided success of this contest, especially from the viewpoint of interest created in electric cooking, in both the children and their parents, is described in a recent issue of the Electrical Review as follows:

This contest was conducted with three ideas in view:

(1) To get the children, and hence the mothers, interested generally in the subject of electric cooking.

(2) To secure new advertising ideas from the other person's viewpoint.

(3) To foster general goodwill in connection with the Christmas season.

The contest was a success in practically every district where it was conducted, and not only was much valuable publicity obtained, but many ideas submitted by the children will be used in the company's advertising during the year.

Four subjects were selected, each of these being used in four districts. These were as follows:

(a) What I Would Do with a Toy Electric Rrange.

(b) Electricity in Everyday Life.

(c) How Mother Might Use Electricity to Lessen Her Work.

(d) Why Mother Should Have an Electric Range.

The contests covered a period of two weeks, during which time the rules were advertised in the newspapers and by means of window displays. In the majority of cases the essays were turned over to the city officials or to the local school authorities, who acted as judges and made the decisions as to the best essays.

In every district the local newspapers carried news items announcing the contest, and also in the majority of cases published the winning essays, with the name of the winner.

In order to further call attention to electric cooking and to compensate in a way for the disappointment of those children who were unfortunate in winning a prize, a personal letter was sent to all unfortunate contestants by the manager of the district, expressing regret that the recipient did not win the prize.

The names of the contestants will be used in connection with the electric cooking campaign now under way, as they will form an excellent avenue of approach to the mothers.

Toronto Electrical Contractors—Are You

All Behind the New Organization Move? If You Have Been Travelling in a Rut, Now is Your Chance to Get Free

The electrical contractors of Toronto have just put the finishing touches on one of the most difficult "jobs" that ever have to be tackled by any class of men working in the same line of business.

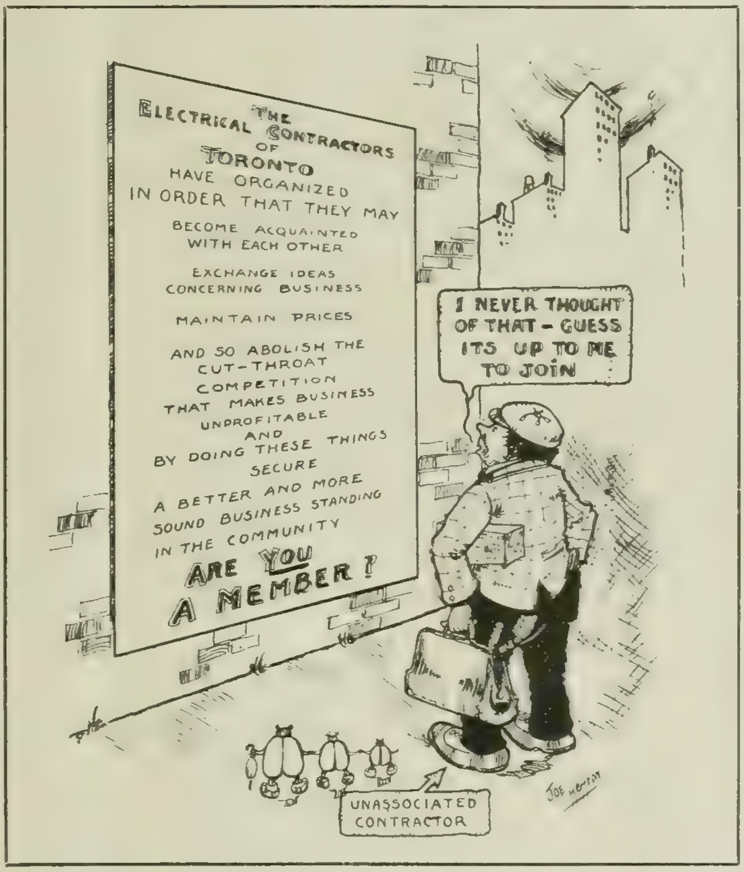
They have got acquainted with one another.

And, much to everybody's surprise, the **other fellow** turns out, on closer inspection, to be far more human than was expected—quite amenable to reason and argument (like ourselves); fighting the very same battles; longing, like the rest of us, for a word of encouragement and a helping hand.

And so, by a gradual process of evolution, the contractors of Toronto are already working together in actual fact. Next Friday—April 4—they organize **in name.**

It must have been a pleasure to anyone who has watched this gradual process working itself out to note the growing signs of friendliness and comradeship developing among the members of the electrical contracting profession. At first they came together as competitors — suspicious, unsympathetic, in some cases openly hostile. Now each meeting is as it ought to be—a gathering together of old and trusted friends.

So far, business talk has been tabooed. Perhaps that has been the primary cause of the solid foundation that appears to have been laid. It indicates that the contractors realized that some of their troubles at least originated with themselves. So they began house-cleaning at home first. Now they are ready to take up bigger problems of general interest.


THE ELECTRICAL CONTRACTORS OF TORONTO HAVE ORGANIZED IN ORDER THAT THEY MAY
BECOME ACQUAINTED WITH EACH OTHER
EXCHANGE IDEAS CONCERNING BUSINESS
MAINTAIN PRICES
AND SO ABOLISH THE CUT-THROAT COMPETITION THAT MAKES BUSINESS UNPROFITABLE
AND BY DOING THESE THINGS SECURE A BETTER AND MORE SOUND BUSINESS STANDING IN THE COMMUNITY
ARE YOU A MEMBER?
I NEVER THOUGHT OF THAT - GUESS ITS UP TO ME TO JOIN
UNASSOCIATED CONTRACTOR

One of the big problems before the electrical contractors in Toronto, as in every other district, is that of licensing. Manitoba has made the plunge, and the local legislature of the province has already passed an act. This reported elsewhere in this issue. There can be no doubt, surely, that some sort of check must be put upon the men who assume the responsibility of installing electric wiring and equipment. It is only common justice to the public. Further than that, it is only fair that the skilled electrician should have some form of protection against the irresponsible, incompetent individual who assumes obligations he cannot fulfil, and fails at the expense of the consumer and of the reputation of electrical contractors in general.

In looking for the causes underlying the unanimity with which Toronto electrical contractors are working, the pioneering of the past years must not, of course, be lost sight of. For many years there has been in existence a Toronto Electrical Contractors' Association, which, though limited as to membership, included many of the most aggressive and most of the large contracting firms in the city. Some two years ago, also, there was a strong association formed, known as the Electrical Contractors' and Dealers' Association, which was strong numerically, and was responsible for a very considerable amount of valuable work along a number of lines. The present organization has only been made possible through the generous and hearty co-operation of the officers and the rank and file of these two earlier associations, who have consented to sink their identity in a common organization, believing that only in this way can the greatest good come to the greatest number.

The new association starts out, therefore, under the most favorable auspices. Let every electrical contractor in the city give his co-operation. Do not look for immediate, tangible gain. The idea rather is to bring **all** the electrical contractors up to a certain standard. Many undoubtedly are above this common standard already, but that simply shows that **their** duty lies in helping a less fortunate brother. It is, of course the man who is below standard who stands to profit most, and, so, **the appeal is to all.** Whatever your status in the business, your place as a contractor is in the membership of the association. Don't argue that the initiation fee is too big, the annual dues too onerous, or the monthly dinner too expensive. Build for **to-morrow.** Your association with your fellow-contractors will broaden and educate you, make you a bigger man, capable of larger and more profitable business in the future.

If you are in a rut, now is the opportunity to get out.

Remember the date—Wednesday night, April 4, Carls-Rite Hotel, 7.30 as usual. Tickets are obtainable only up to March **31**, so, like the good business man that you are, make your plans ahead and stick to your schedule.

The New Brunswick Power Company, St. John, N.B., have taken over the St. John Valley Railway Company, and have announced a cut of from 5 to 30 per cent. in electric lighting rates and also a considerable cut in power rates, in some cases as much as 50 per cent. below those of the old company.

Electrical Contractors are Now Licensed

In Manitoba—Act Has Just been Enacted—Examining Board of Three Members Appointed by the Government.

In October, 1915, a committee was appointed by the Electrical Section of the Manitoba branch of the Canadian Society of Civil Engineers to study the matter of the regulation of electrical contractors and wiremen, and to report their findings to the branch, together with recommendations for provincial legislation.

The committee was composed of the following: Mr. F. A Cambridge, city electrician, Winnipeg; Mr. George F. Guy, electrical engineer, Manitoba Public Utilities Commission; Mr. E. V. Caton, chief engineer, City Light and Power Department, Winnipeg; Mr. J. M. Wilson, lecturer on electricity, Kelvin Technical School, Winnipeg, and Mr. J. M. Leamy, provincial electrical engineer, Manitoba Government.

Mr. Leamy was elected chairman of the committee, and all of the operations and work of the committee, from the start to the finish of its work, was carried out under his chairmanship.

A study of similar legislation passed in all parts of the country or suggested for adoption was made, and, as a result it was decided that a bill which would be simple in construction and interpretation, which would contain few provisions, which would be complete in its embrace of the factors affected —that is, regulation of wiring contractors and their employees, and the work carried on by them—which would contain stringent penalty clauses, and which would admit of ready exception of various operations and interests from its application, was desirable.

In order to get the public feeling in the matter the committee invited to its meetings representatives from the various interests which would be affected by the act. The representatives from the following bodies were consulted with and readily gave their co-operation: The labor unions, the contractors' associations, the builders' exchanges, the architects' association, the manufacturers and supply men, the public service corporations, and the fire underwriters' associations.

Provisions of the Bill

The committee carried on its work over a period of fourteen months, and the bill herewith, as passed by the Manitoba Legislature, is the result.

In brief, it provides for the examination and certification of all electrical contractors and wiremen in the province, the appointment of a board of examiners, and the imposition of fines or imprisonment on persons operating in contravention of the act. It excepts from the operation of the act the employees of public service corporations, unless such are engaged in electrical contracting. It also excepts the holders of first and second-class stationary engineers' licenses, who may carry on the work of maintenance of electrical elements in the plants in which they are employed, but all other persons engaged in electrical contracting or work as electrical wiremen are brought within the operation of the act.

The act does not touch on the class or quality of materials employed in electrical work. It has to do only with the men engaged in the same, and provides only for their examination and licensing.

The bill, we understand, is satisfactory to the committee, who anticipate a great improvement in conditions. The irresponsible and unqualified person who now works as an electrical contractor will be eliminated, and the provisions made for the journeymen ensure that employment of boys and unqualified persons, as now obtains, will cease. The specific inclusion of penalty clauses ensures the enforcement of the measure.

An Act Respecting the Examining and Licensing of Electrical Contractors and Journeymen Electricians.

His Majesty, by and with the advice and consent of the Legislative Assembly of Manitoba, enacts as follows:

1. This act may be cited as "The Electricians' License Act."

2. In this act, unless the context otherwise requires—

(a) "Minister" shall mean the Minister of Public Works;

(b) "Board" shall mean the board of examiners appointed as hereinafter provided;

(c) "Department" shall mean the Department of Public Works;

(d) "Contractor" shall mean and include any person, firm, or corporation having a regular place of business, who or which, by the employment of journeymen, performs the work of installing wires, conduits, apparatus, fixtures, and other appliances for the carrying or using of electricity for light, heat, or power purposes, within the meaning of this act;

(e) "Journeyman" shall mean a person who does any work of installing wires, conduits, apparatus, fixtures, and other appliances for the carrying or using of electricity, for light, heat, or power purposes, within the meaning of this act, for hire;

(f) "License" shall mean the certificate of qualification issued to a contractor or journeyman under the provisions of this act;

(g) "Inspector" shall mean a person appointed under the provisions of this act, as hereinafter provided;

3. (a) This act applies to all contractors and journeymen engaged within the province in the business of placing, installing, maintaining, repairing, or replacing, in or on any class of structure, any conduits of any description, designed for the purpose of enclosing or carrying any electrical conductor, upon which is impressed an E.M.F. of more than fifty volts, between any two conductors and ground, independent of the characteristics of the current; of placing, installing, maintaining, repairing, or replacing in or on such structures, of any conductor switch, attachment, fitting, or any element whatsoever of an equipment designed for the purpose of supplying such electrical service, or for any purpose in connection with such an electrical service.

(b) This act shall not apply to such work within power houses, sub-stations, or others places wherein the business of generating or distributing electrical power is carried on by public service corporations or by municipal departments, and where such work is installed by employees under the direction of officers of such public corporations or municipal departments, except in structures wherein the public, other than employees of such public service corporation or municipal department, have free access on business.

(c) No apprentice or helper, or other person, shall perform or install any electrical work within the meaning of this act, except as an assistant under the direct personal supervision of a journeyman licensed under this act.

(d) This act does not apply to such work on street railway cars or locomotives, or on railway cars or locomotives, which are the property of municipal departments or of public service corporations, and where such work is installed by employees under the direction of officers of such municipal departments or public service corporations.

(e) Nothing in this section shall be taken to apply to the insertion of incandescent lamps in sockets or receptacles, or the replacement of such lamps, the carboning, trimming, or operation of arc lamps, the lawful connection of utilization equipment to supply circuits by means of attachment plugs or the use or operation of the same, or the lawful replacement of fuses controlling circuits or equipment.

4. All electrical contractors and journeymen carrying on their work in the Province of Manitoba shall be subject to examination before a board of examiners, appointed under the provisions of this act; and upon the fitness of such contractors and journeymen being established before such board of examiners, licenses as provided for under this act shall be issued to such contractors and journeymen.

5. The Lieutenant-Governor-in-Council, upon the recommendation of the Minister, may appoint a board of examiners, consisting of three members, who shall be qualified in electrical engineering and construction, and who are not connected in any way with the business of electrical contracting, or with labor organizations, and who are conversant in a practical degree with the qualifications necessary to be held by a person described as an electrical contractor or an electrical journeyman, who shall hold office during pleasure, and who, subject to the regulations mentioned in the next following section, and to the approval of the Lieutenant-Governor-in-Council, shall prescribe the subjects in which candidates for a contractor's or journeyman's license shall be examined, and conduct and provide for and supervise the examinations of candidates and report thereon to the department.

6. The Lieutenant-Governor-in-Council, on the recommendation of the Minister, may appoint inspectors, one of whom may be chief inspector, and such other officer or officers as may be deemed advisable for carrying out the provisions of this act, and such inspectors shall be persons who, in the opinion of the Minister, have had the necessary practical experience to qualify them for the positions.

7. The Lieutenant-Governor-in-Council, upon the recommendation of the Minister, may make regulations for—

(a) The examination of candidates for contractor's and journeyman's licenses, the granting of licenses, and the evidence to be furnished by candidates for contractor's or journeyman's licenses as to previous experience;

(b) Determining time and duration of licenses, and their renewals;

(c) Fixing the fees to be paid to the government by the contractors and journeymen for licenses and examinations;

(d) Prescribing causes for which a license may be revoked, cancelled, or suspended;

(e) Defining the duties of inspectors, and making rules governing their operations;

(f) Fixing the salaries or other remuneration to be paid to the examiners and inspectors so appointed.

8. Upon it being established to the satisfaction of the Minister that any of the prescribed causes for which a license may be revoked, cancelled, or suspended exists, he may revoke, cancel, or suspend the same accordingly.

9. Any person, firm, or corporation in the Province of Manitoba desiring to carry on the business of installing any element of electrical service, in any structure as described and defined in section 3 of this act, shall be described as an electrical contractor, and said person or some member of said firm or some officer of said corporation shall apply for examination, and after passing same, and paying the fees therefor as provided for under sub-section (c) of section 7, of this act, shall be given a license enabling such work of electrical contracting to be carried on, such license being subject to regulations provided for by paragraphs (b) and (d) of section 7 of this act.

10. Every person, or some member of a firm or officer of a corporation, desiring to carry on the business of an electrical contractor in the Province of Manitoba shall, in addition to the possession of a license to carry on such business, be required to apply for, and pass, the examination for journeyman's license, and to take out the same before engaging in such business, and such license shall be subject to the same regulations as a contractor's license.

11. Any person or corporation, who or which, after the first day of January, 1918, carries on such business of electrical contracting without authority of a valid and subsisting license therefor issued under this act shall be guilty of an offence punishable, on summary conviction before a justice of the peace, by a fine of not less than fifty dollars nor more than two hundred dollars, and, in default of immediate payment, by not more than three months' imprisonment.

12. Any person in the Province of Manitoba desiring to secure employment as an electrical journeyman, as described under section 3 of this act, shall apply for examination, as provided under paragraph (a) of section 7 of this act, and after passing such examination and paying the prescribed fees a license shall be issued him under this act.

13. Any person who, after the first day of January, 1918, engages in the work of an electrical journeyman in the Province of Manitoba, without authority of a valid and subsisting license therefor, shall be guilty of an offence punishable, on summary conviction before a justice of the peace, by a fine of not less than five dollars nor more than fifty dollars, and, in default of immediate payment, by not more than two months' imprisonment.

14. The possession of a first or second-class stationary engineer's certificate, issued under "The Steam Boiler Act," being chapter 103, Manitoba Statutes, 6 George V., or of any other certificate which may be issued under the said act, of a grade not lower than such first or second-class certificates, shall entitle the holder of any such certificate to perform the work of a journeyman electrician as described in this act in or about the premises wherein he is employed as a stationary engineer, but not elsewhere.

15. In the case of industries where workmen are engaged in repair or maintenance of electrical equipment, solely in or upon the premises upon which such industries are carried on, any such workmen shall be granted a special license to do such work in or upon such premises upon demonstrating to the satisfaction of the board of examiners that he possesses sufficient qualification for the work intended to be performed in such premises. No such special license shall entitle the holder to perform any electrical work outside the premises described in the license, nor shall such license be transferable.

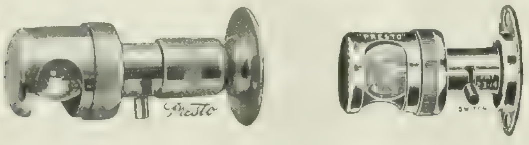
16. Each member of any firm and the managing director or other responsible officer of any corporation carrying on the business of an electrical contractor in the Province of Manitoba, who or which, after the first day of January, 1918, has not, as a member of the firm or officer of the corporation or in its employ at least one person in possession of a valid and subsisting journeyman's license, shall be guilty of an offence punishable, on summary conviction before a justice of the peace, by a fine of not less than fifty dollars nor more than two hundred dollars, and, in default of immediate payment, by not more than three months' imprisonment.

17. If, on demand from any duly appointed inspector of the department, any person, performing the work of an electrical contractor, or an electrical journeyman, does not produce satisfactory evidence of his being in possession of a valid and subsisting license therefor, he shall be guilty of an offence punishable, on summary conviction before a justice of the peace, by a fine of not less than fifty dollars and not more than two hundred dollars, and, in default of immediate payment, by not more than three months' imprisonment.

What is New in Electrical Equipment

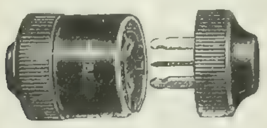
Two New Dash Lamps

The Metal Specialties Manufacturing Company, Chicago, Ill., is marketing two new dash lamps, made especially for the new cowl dashes that are being turned out by speedometer manufacturers for use on the Ford car. With these dashes the Ford car now has an instrument dashboard in which the speedometer is set flush, thus demanding special lamps. Some of the dashboards are made of steel and some of wood with a covering. The lamp designed for use with the wood dash is called the "Bull Pup" No. 647-S; the one for the metal dash, the "Bull Terrior," No. 655-S. The illustration shows there is a switch in each lamp so that the lamp can be turned on or off at will.

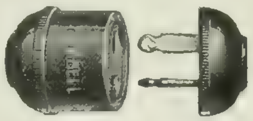


Hubbell Connectors

The illustrations herewith represent No. 6408 three-wire composition cord connector and No. 6821 small polarized connector, both of which are recent additions to the Harvey Hubbell line. The extensive use of the three-wire line, introduced by this company about three years ago, has made necessary the addition of a durable 10-ampere cord connector, which can be used in linking up permanently installed wall or flush receptacles with portable machines, appliances, and laboratory apparatus wired for three-wire work. The composition cap of this connector is interchangeable with all of the three-wire attachment plug bases, wall receptacles, and flush receptacles listed by us. The No. 6821 small composition cord connector meets the demand for a small, inconspicuous connector of durable construction to be used in connection with the Hubbell line of interchangeable attachment plugs, wall and flush receptacles. The cap of this device is interchangeable with both polarized and non-polarized Hubbell wall and flush receptacles as well as the line of small attachment plugs.



No. 6821—⅜ actual size.



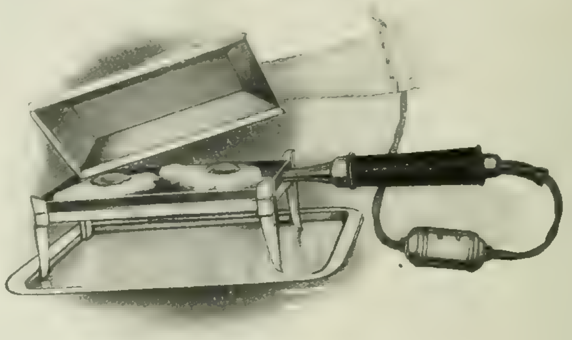
No. 6408—[illegible] actual size.

To Electrical Men Throughout the Dominion

If you are in the electrical industry, take a trip out west during August; see Vancouver's Electrical Show; attend the Annual Convention of the B. C. Association of Electrical Contractors and Dealers; visit the Vancouver Exhibition—All during the week August 20th to 25th. If you are an electrical man and want a good time, notify Secretary E. Brettell, 781 Granville Street, Vancouver, B.C., and be assured of a welcome on the Pacific Coast.

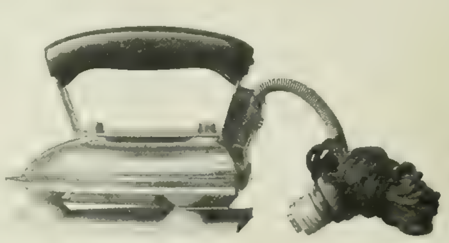
Immersible Table Stove.

The illustration herewith shows a new Cutler-Hammer table stove, consisting of a steel stand and a rectangular deep water pan with cover, all nickel plated. The heater consists of two steel plates welded together and enclosing between them the heating element. The water pan and heater are provided with ebonized wooden handles. Additional accessories furnished with this stove are a toasting screen and a broiling screen. It is equipped with six feet of flexible connection cord and a three-heat switch. One side of the heater serves as a frying pan, while the other side is a griddle or hot plate. When used for boiling or steaming the water pan is placed on top of the heater and the food cooked directly in the pan or in a dish immersed in the hot water. Inverting the water pan over the heater forms an oven, while placing the heater over this pan permits chops and steaks placed therein to be broiled. Toasting can be done by putting the wire screen on top of the heater. A noteworthy feature of this stove is that it can be entirely immersed in water for cleaning, even to the heating element, if care is taken not to wet the handle.



Westinghouse Three-pound Iron.

The Westinghouse Electric and Manufacturing Company have developed a small iron for domestic use and particularly convenient for travellers. It weighs only three pounds, and the handle is not removable, as in the former model, thus avoiding the likelihood of losing or misplacing it, which the space required for packing is about the same.



Dr. Louis Herdt has been appointed technical advisor to the commission recently appointed to take evidence as to the proposed new franchise of the Montreal Tramways Company.

Estimates will be secured by the Utilities Commission, Springbank, Ont., on the cost of raising the dam at the waterworks pumping station and rearranging the pump house and tail race, with a view to developing 1,500 h.p. of electric current.

Something New for Show Window Illumination Made in Canada

Keeping pace with the new gas filled Mazda (or type C) lamps are the newest Holophane prismatic reflectors, No. 8,300 (Fig. 1), and No. 983 (Fig. 2), manufactured in Canada by the Canadian General Electric Company. These reflectors are valuable in that they are of a high efficiency, fulfill the requirements of the majority of show windows and are sold at an exceptionally low figure. Fig. 1 is a powerful concentrator designed specially for very high, shallow windows, while Fig. 2 gives an angle distribution that in turn applies to the square and low deep windows. Fig. 3 is a photometric curve showing reflector No. 983 used with a 100 watt, type C, lamp. Fig. 4 is a cross section scale giving instructions how to use the two types. Though the lamp recommended is the new 100 watt, type C, Mazda, the new 75 watt or old type 100 watt, evacuated (Type B) Mazda may also be used. The form H or deep 2¼ in. shade holder is required. The Holophane prismatic reflector will reflect the true color of the lamp it covers, reflects powerfully and at the same time transmits sufficient light through its prisms to illuminate any transparent signs at the top of the window that may be desired.

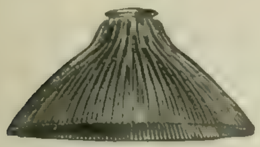


Fig. 1.

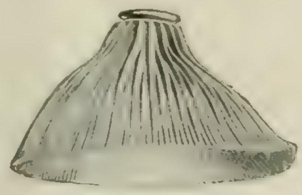


Fig. 2

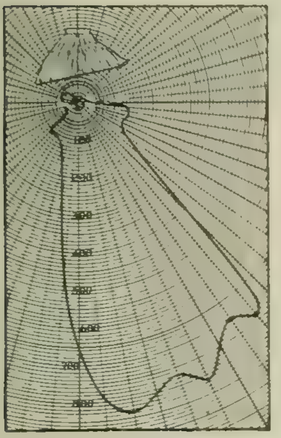


Fig. 3.

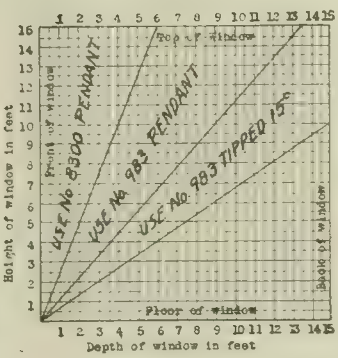


Fig. 4.

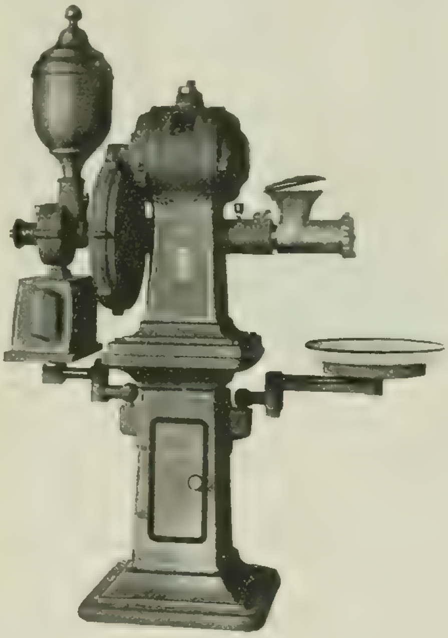
Vancouver's Electrical Show

At the regular monthly meeting of the B. C. Association of Electrical Contractors & Dealers held in the association rooms in Vancouver on Tuesday, March 6th, the general organization committee of Vancouver's first electric show was appointed. The committee, which is considered a very strong one, consists of Messrs. E. E. Walker, sales engineer, B. C. Electric Railway Company (Chairman); John R. Read, district manager, Canadian Westinghouse Co.; J. F. Little, sales manager, Northern Electric Company; S. E. Jarvis, Jarvis Electric Company; and E. Brettell, Electric Supply Company, Ltd. This committee was given full organization powers to appoint sub-committees and was requested to go ahead at once with the work of organization. The spirit of the electrical fraternity on the Pacific Coast may be understood when it is stated that all the available space at the Show has already been taken up. It is now up to the committee to endeavor to secure additional spaace so that the applications which are still being received may be accommodated. Full particulars may be obtained on application to Secretary E. Brettell, 781 Granville Street, Vancouver, B.C.

A Combination Grinder

The combination mill and meat grinder shown has been placed on the market by the Coles Mfg. Company of Philadelphia, Pa. It has a capacity of 8 pounds of beef per minute, or will granulate two pounds of coffee per minute. It is operated by a ¾ h.p. Westinghouse motor. All parts, including the bowl, are removable. The regular equipment consists of four sets of knives and plates, one sausage stuffing attachment, meat pusher, spanner wrench for chopper ring. Bone grinder, pulley, or tool grinder also furnished when desired. It is furnished for mounting on the counter or with pedestal base for floor mounting. It occupies a counter space 26 by 32 inches, and is 36 inches high.

A double mill, also manufactured by this company, will granulate five pounds of coffee per minute, or pulverize one pound per minute. It is operated by a ¾ h.p. Westinghouse motor. The motor operates both grinders at the same time. This mill has an automatic releasing and resetting device, selfcleaning heads, dustproof pans, indicating regulator which provides for twenty grades of coffee, and six pound nickel hoppers. It is furnished for mounting on the counter or with pedestal base for floor mounting.



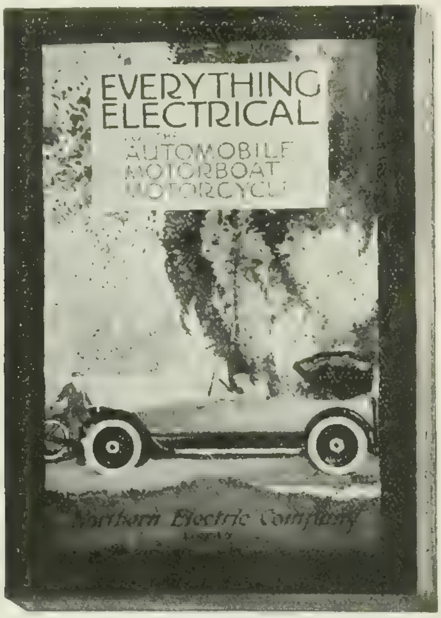
Canadian Inventor Awarded "Civic Forum" Medal

Alexander Graham Bell, inventor of the telephone, was awarded the Civic Forum gold medal for distinguished public service at New York on March 21. The presentation address was made by Dr. John H. Finley, state commissioner of education. Dr. Bell is the third to receive the medal, which has only been awarded previously to Major George W. Goethals, of Panama Canal fame, in 1914, and to Thomas A. Edison in 1915.

The Davidson Mines, Timmins, Ont., are making arrangements with the Porcupine Power Company by which a power line will be extended to the company's properties, which are located just one and one-half miles from the town of South Porcupine. The company have been burning wood for power purposes, but feel that it will be more advantageous to utilize electric power as quickly as possible.

An Attractive Catalogue

The new Automobile Accessory Catalogue just issued by the Northern Electric Company, Limited, of which the cut herewith is a reproduction, sets an altogether new standard of beautiful printing for a catalogue of this nature. The front and back cover designs were made by Myron Perley, who is probably the greatest commercial impressionistic artist on the American continent. These designs were reproduced from four-color process plates and give an unusually pleasing effect. The catalogue contains a very complete listing of high grade electrical accessories for automobiles, motor boats and motorcycles. There are 118 pages in the book, as well as the general index and a special Ford material index. The complete catalogue, including the making of the plates, was done in Montreal.



Winnipeg Jovian League Is Active.

Under date March 13 the secretary of the Winnipeg Jovian League writes:

"On March 8 the Winnipeg Jovian League listened to an address of great clearness and containing most instructive material from Dr. Magill, late chairman Board of Grain Commissioners of Canada, and at present secretary of the Winnipeg Grain Exchange. All members present received enlightenment on the truth and facts in connection with the handling of the Western grain crop and the large part played in this by the Winnipeg Grain Exchange. President E. H. Smith reported progress on the bonspiel and the finals on the premier event, and the knock-out competition for the consolation prizes will likely be cleaned up during the week of March 12. Forty-five members and guests sat down to the above luncheon. The next event is March 22, when Brigadier-General Ruttan, O.C.M.D. No. 10, addresses the league on the subject, 'Returned Soldiers After the War.'"

Secretary Duffield Resigns

After seven years of continuous service, George H. Duffield, secretary of the National Electrical Contractors' Association of the United States, and business manager and editor of the Association's official journal, the National Electrical Contractor, resigned February 1st to take effect April 1st. Mr. Duffield has accepted a position with the McGraw-Hill Publishing Co., Inc., New York, as business manager of "Electrical Merchandising," and will also serve in an editorial capacity.

H. C. Brown, former assistant secretary of the N. E. C. A., has been appointed secretary, also business manager of the National Electrical Contractor, to fill the unexpired term of Mr. Duffield until next October, the time of the annual convention. H. G. Smith is assistant secretary, and L. C. Fletcher assistant manager and associate editor on the journal. The headquarters will remain at Utica, N.Y.

Boosting Benjamin Business

The Benjamin Electric Company, Toronto, are inaugurating a Dominion-wide publicity campaign, designed to place before the eight million odd citizens of Canada the merits of the now famous "Benjamin 92." This campaign will take the form of advertisements in the chief trade magazines and newspapers from Halifax to Vancouver; window trims, to be supplied to jobbers and dealers; counter stands; dealers' helps, in the form of folders explaining the why and wherefore of the Benjamin Company, and endeavoring to educate the trade as to what the name "Benjamin" stands for, both in quality and service; three-color envelope stickers, etc., Such a campaign will exert a wide influence on the electrical industry in general, for, as a direct result, the sale of appliances will undoubtedly be stimulated and, following that, the sale of current and current-producing machinery.

Numerous Recent Orders

The Imperial Oil Company, Church Street, Toronto, have awarded a contract to the Turbine Equipment Company to supply, for their new plant at Dartmouth, N.S., 13 De Laval single-stage double-suction pumps, ranging in size from 1,500 gallons a minute to 350 gallons a minute. The Turbine Equipment Company have also received an order to supply and install eight De Laval single-stage double-suction centrifugal pumps for the new filtration plant for the town of St. Hyacinthe. One will be five million imperial gallons daily unit; another four and one-half million gallons daily, and there will be six having capacity of two and a half million imperial gallons daily. All these pumps will be connected direct to Canadian Westinghouse motors. The same company will also supply a 40 h.p. motor-driven Roots blower, complete with switchboard, etc.

City Purchasing More Power

A by-law is to be submitted to the citizens of Sherbrooke, P.Q., in favor of purchasing the property of the Two Miles Falls Power Company, at Weedon, at a cost of $375,000. This will include an undeveloped water power. The by-law provides for raising $500,000, which will enable the property to be purchased, a second unit installed, and a transmission built to Sherbrooke. Walter J. Francis & Co., of Montreal, reported on the proposal for the city, and estimate that the power to be developed from the present plant and the new unit will be 3,800 h.p., and, with the inclusion of the undeveloped site, the total will be about 10,000 h.p.

Claiming that the arrangement between the Ontario Hydro-Electric Commission and the city of Brockville, entered into in 1912, was not working out satisfactorily to the town, a deputation of city officials recently waited on the commission, who decided to prepare new plans with reference to this city, to be submitted in the course of a few weeks.

The Ramsay Township Council, Blakeney, Ont., are considering granting permission to Arthur Burgess, of Carleton Place, Ont., to install a power development at Blakeney, together with transmission line to Carleton Place, twelve miles distant.

An Improved Sign Flasher

The Macey Sign Company, Toronto, are now manufacturing an electric sign flasher which, it is claimed, has many improvements over the earlier designs. A striking feature of the new flasher is the interchangeable sectors. Porcelain pick up blocks eliminate arcing. The brushes are heavy duty, phosphor bronze. These flashers are simple to install, economical to operate, and are guaranteed against electrical and mechanical defects. That they increase the value of the average sign many times over is an acknowledged fact.

Carbon and Alloy Steels Company

The Carbon and Alloy Steels Company, Limited, has obtained a Dominion charter with an authorized capital of $1,500,000. This company will erect furnaces and a foundry plant in Hamilton for the manufacture of steel castings, ingots, etc., by the Moffat electric process. The company will also take over the Moffat-Irving Steel Works of Toronto, which will be moved here and added to the new plant. Plans have been prepared by Prack and Perrine for buildings that will run into about $100,000. The main building will be 60 feet wide and 400 feet long, and subsidiary buildings will cover an equal area. Another $200,000 will be spent in furnaces, electrical equipment, conveyors, cranes, compressors, and other machinery. This plant, when fully equipped, will give employment to about 250 men, and will have a gross capacity of 32 tons of molten steel per 24 hours.

The incorporators of the Carbon and Alloy Steels Company are: J. B. O'Brien, K.C., President Moffat-Irving Steel Works, Ltd., Toronto; H. J. Waddie, Esq., President the Canadian Drawn Steel Co., Ltd., Hamilton; J. W. Moffat, Esq., Vice-president Moffat-Irving Steel Works, Ltd., Toronto; John G. Gauld, K.C., Gauld, Langs & Crosthwaite, Hamilton; W. E. Vallance, Esq., late of Wood, Vallance & Co., Hamilton.

New Books

Interior Wiring—by Arthur L. Cook; John Wiley & Sons, New York, publishers; $2.00 net. A manual of practice for electrical workers, contractors, architects and schools on interior wiring and systems for electric light and power service. It has been written particularly for electrical workers who wish to become familiar with the latest practice in electrical installations, and is intended primarily for superintendents, operators, and wiremen. The attempt has been made in this book to take up the various subjects where the ordinary text book leaves off, so as to compensate in a measure for any lack of practical experience.

Electrical Pocket Book—The "Mechanical World" Electrical Pocket Book for 1917 is a collection of electrical engineering notes, rules, tables and data, published by Emmott & Co., Ltd., Manchester and London, and in the United States by the Norman, Remington Company, Baltimore. The present issue is larger than in previous years, one of the additions being a lengthy section on electrical measurements and testing. There are also new sections on transmission line calculations and on wiring systems and methods. The section on electrical meters has been enlarged to include mercury meters and the section of lighting circuits and switching has been revised. Bound in green cloth, 4 in. x 6 in., 240 pages; 50c post paid. The appendix contains a diary for 1917 and a quantity of useful tables.

Trade Publications.

Sangamo Meters—bulletin No. 46, very completely illustrating and describing the Sangamo Electric Company's alternating current watthour meters, single-phase and polyphase; also bulletin No. 45, describing and illustrating Sangamo ampere-hour meters.

Westinghouse publications—"Manager Wise Buys Westinghouse Small Motors," the twenty-sixth issue of this periodical; leaflets 3935, 3942, 3928, illustrating and describing Westinghouse electric ranges; leaflet 3956, direct-current magnetic contactor controllers; catalogue 5-B, illustrating and describing Westinghouse railway accessories; catalogue 8-A, Westinghouse electric fans for 1917.

Personals

Mr. George H. Montgomery, K.C., has been elected director of the Civic Investment and Industrial Company, Limited, which controls the Montreal Light, Heat and Power Company.

Mr. A. S. Clarson, engineer of the city of Verdun, has been appointed consulting engineer of the city in connection with the proposed underground conduit system, estimated to cost $200,000. Plans and specifications drawn up by Mr. Timberlake are already in existence and these will be utilized, if suitable, in the new scheme.

Mr. E. L. Roxborough, who for nine years has been connected with Keith's Limited, is now in charge of the fixtures and contracting department of E. F. W. Salisbury. This latter firm have just secured the contract for wiring and lighting the large steel plant of "British Forgings, Limited," now being erected at Ashbridge's Bay, Toronto.

Mr. C. J. Hunt, who until recently was chief contract engineer to Bruce Peebles & Company, Limited, Edinburgh, has been appointed chief engineer to the company, and Mr. Wm. Oliver, who has for some time been acting chief estimating engineer (in the absence of Mr. R. Shaw on active service) has been appointed chief contract engineer.

Mr. John J. Carty, chief engineer, American Telegraph and Telephone Company, New York, has been awarded by McGill University the honorary degree of LL.D., "in consideration of his high standing as an engineer, for his work in connection with the development and successful operation of wireless telegraphy, and for his energetic support of pure scientific research as an aid to industry."

Mr. George C. Knott has resigned as sales and advertising manager of the Wirt Company, Philadelphia, and formed a partnership with Mr. George L. Hatheway. The new company will be known as Hatheway & Knott, with offices at 120 Liberty Street, New York, and will engage in the distribution of products of various electrical manufacturers. Mr. Knott was for many years associated with the Benjamin Electric Manufacturing Company and Mr. Hatheway was formerly with Pass & Seymour. Both are widely known in the United States and Canada. They will maintain a Canadian connection, representing throughout the Dominion the following concerns: Manhattan Electrical Supply Company, Steel City Electric Company; Killark Electric Company, Capital Porcelain Manufacturing Company, Eastern Flexible Conduit Company, National Electric Porcelain Company

Current News and Notes

East Angus, Que.

Plans have been drawn for the Brompton Pulp and Paper Company, East Angus, Que., for a concrete dam and power development on the St. Francis River, between Ascot and East Angus. The work, which will start at once, is estimated at $750,000.

Enderby, B.C.

The Town Council of Enderby, B.C., are collecting data re installation of an electric lighting plant.

Galt, Ont.

A 30-foot extension to the hydro-electric station at Galt, Ont., is now nearing completion. Some of the machinery has already been placed, and will be in operation in the near future.

The Galt, Ont., hydro-electric commissioners have decided to extend the street lighting on Hespeler Road and on Beverly Street. An effort is also being made to have the ornamental lighting system extended up Blenheim Road to Mount View Cemetery.

Guelph, Ont.

The annual report of the Guelph Radial Railway Board, recently submitted, showed a profit for the year of $844. The following officers were elected for the current year: J. W. Lyon, president; E. Buckingham, vice-president; C. E. Howitt, treasurer; Ald. H. Westoby, secretary.

Montreal, Que.

Shawinigan Water and Power Company's earnings for the month of January amounted to $192,000, which is at the rate of $2,304,000 per annum. This compares with earnings of $160,000 in January, 1916, which were at the rate of $1,920,000 per annum. The increase of the month over last year is $32,000.

Niagara Falls, Ont.

Shortage of power on the United States side of the Niagara Falls has resulted in the amalgamation, or reorganization, of the two big companies on the American side, and, it is stated, the change affects the Canadian Niagara Power Company, in that certain of the interests identified with it have been persuaded to relinquish their holdings and that control has been taken over by the central directorate that controls the International Traction Company, operating in the western part of New York State.

North Vancouver, B.C.

Acting Engineer A. R. Clucas, North Vancouver, B.C., has submitted a report to the City Council covering the possibility of developing water power on Lynn Creek. Two schemes were suggested, but Mr. Clucas cautioned the council against going into any large or expensive undertaking until the flow of the creek has been gauged for at least five consecutive years. At any rate, he stated, it was impossible to develop power on this creek without building very large storage

Porcupine, Ont.

The Northern Canada Power Company, Porcupine, Ont., are raising the capacity of their plant from 8,000 to 13,000 h.p. One unit of 2,500 h.p. is now being installed and a second unit will be installed during the next few months. It is also understood that a dam will be built across Redsucker Creek at a point below the mouth of Cripple Creek, for the purpose of diverting these waters through another channel into the Matagami River above Wawiatin Falls, the site of the plant.

Prince Rupert, B.C.

Arrangements are being made with the Prince Rupert, B.C., Water and Light Department for a supply of power to be used by the sawmill about to be built at Seal Cove by the Emerson interests of Vancouver.

Radville, Sask.

The Town Council of Radville, Sask., contemplate the installation of an electric lighting plant. Will probably require a 100 h.p. gas engine and 50 kw. generator.

Rosthern, Sask.

The Town Council of Rosthern, Sask., are considering the installation of an electric lighting plant.

Shaunavon, Sask.

The Town Council of Shaunavon, Sask., contemplate the installation of an electric lighting plant. Proposed equipment is a 100 h.p. gas engine and 50 kw. generator.

St. Thomas, Ont.

The St. Thomas, Ont., street railway contemplate extending their line to Queen and Centre Streets.

Toronto, Ont.

The annual report of the Canadian General Electric Company for the year 1916 is the best in the history of the company. The profit and loss account shows a gross profit of $2,225,912, nearly 83 per cent. increase over the previous year.

Winnipeg, Man.

Winnipeg Electric earnings for January show an increase of $22,034 over the same period in 1916, the amounts being respectively $319,945 and $297,911.

Make Stronger Splices
[illegible]
ALLEN
Non Acid Sodering Flux.
[illegible]
name.
[illegible]
HOUSTON & CO., Ltd.
Cumberland Blk., Winnipeg
22 College St., Toronto
1825 Scarth St., Regina
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ALUMINUM
ELECTRICAL CONDUCTORS
Ingot Sheet Wire Rod Tubing
Northern Aluminum Co. Limited
1305-6 Traders Bank Bldg.
Toronto, Ont.

Electrical News
Generation, Transmission, and Application of Electricity

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ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Vol. 26 **Toronto, April 15, 1917** **No. 8**

Joint Committee of Technical Organizations' Annual Report

The first annual report of the Joint Committee of Technical Organizations, Ontario branch, was presented at a meeting held in the C. and M. Building of the University of Toronto, on Friday evening, March 30, the chairman, Mr. Alfred Burton, presiding. There was a splendid attendance from all branches of the organization, and the greatest unanimity and optimism prevailed that such a representative body of technical men possessed almost unbounded potentialities for serving the Empire, both during and after the war, by lending their trained experience as an assistance in the solution of national problems.

As typifying the comprehensive character of this organization the three main speakers of the evening had been chosen both as to locality and interests, to represent three entirely different fields of action: Mr. E. P. Mathewson, general manager of the British America Nickel Company; Mr. John Murphy, electrical engineer, Department of Railways and Canals, Ottawa, and consulting engineer to the Dominion Railway Board; and Mr. R. A. Ross, consulting engineer, Montreal, a member of the Industrial Advisory Council.

All the speakers expressed their belief that the time had now arrived when the technically-trained men in Canada must come forward and take a more prominent part in public affairs. The development of Canada in the future must be largely a matter for technical men; our minerals, our water powers, our resources in land and forest—all call for treatment by scientific methods. It will be criminal neglect if we, as engineers, leave the administration of this land of promise in the hands of professional politicians. The duty of the engineer lies not only in his professional career, but in the broader work of organization and administration for which his training specially fits him.

For such work as this, of equal importance to all branches of the technical profession, the Joint Committee of Technical Organizations appears to be specially fitted. It is an organization of professional men, but its aims are of a national and not in any sense of a professional character. Its activities, therefore, need not in any way overlap with those of the various engineering societies whose aims are purely professional. On the contrary, it may be of the very greatest benefit to those societies, in that, by bringing to bear the greater numbers and more varied experiences of its members, any special aim of any particular society may receive the greater consideration and support necessary to carry it to fruition.

As more than one of the speakers expressed it, this getting together of technical men for one common aim is not the result of a chance idea, but is the natural result of modern and present circumstances. The organization has been called into being because its need is already established. It will remain because it is right. It is the awakening of the engineer to a more perfect realization of his larger duties.

Unnecessary Fire Hazards

The Hydro-Electric Power Commission of Ontario asks us to direct the attention of our readers to the fact that manufacturers of electric heaters are being cautioned against the use of switches on portable heaters which are too small. The commission has recently been obliged to condemn a number of electric heaters for this reason, and manufacturers are urged to follow closely the rules and regulations. Where there is any doubt as to the requirements, manufacturers are invited to communicate with the electrical inspection department, so that all misunderstandings may be removed.

Another item which it is expected the commission will take up in the near future is that of the sale and use of electric appliances of high capacity in screw-base sockets. The ordinary key lamp socket has a rated capacity of only 250 watts and the keyless of 660 watts. Yet there are, as we all know, numerous cases where cooking and heating appliances with capacities well up to 1,000 watts are being sold and used with screw-plug attachment. It is, of course, a difficult matter to regulate. The manufacturer or dealer may refuse to attach a screw-plug to any of his equipment having a capacity greater than 660 watts, but this will not prevent the householder from buying a plug himself and using it on whatever lamp base in his home he may feel inclined. The law in this matter, however, should be made perfectly clear, so that manufacturers and dealers will know where they stand. At the present time the lack of definite information as to just what is allowed is working some hardship on the conscientious dealer. It would not be going too far, apparently, to have an order issued by the Hydro-Electric Power Commission to the effect that it is illegal to sell an article having a greater capacity than 660 watts, with a screw-plug attachment.

Montreal Electrical Luncheon

The following are the future speakers so far arranged for the Montreal electrical luncheons: April 11, Dr. Mullally, "The Place of the Medical Profession in Modern Industry"; April 18, Mr. H. E. Howe, Arthur D. Little Company, "Natural Resources Survey"; April 25, Mr. Tremblay, chief of the Montreal Fire Brigade; May 16, Mr. M. J. Gorman, United States emigration officer; May 23, Mr. J. Pitblado, "Stock Exchange Operations."

Good Suggestion from Saskatoon

Saskatoon, Sask., March 29, 1917.

Editor Electrical News:

Dear Sir,—On reading the "Help Wanted" columns of the daily newspapers one notes how often the same people have to advertise for domestic servants. It seems to me that these advertisements should give the enterprising dealer a pretty good "lead" as to prospects for electrical apparatus.

The following letter might be used to advantage:

> Dear Madam,—You know how heartbreaking the domestic servant problem is; how difficult it is to get and to keep a reliable girl.
>
> Have you ever considered electricity as a substitute
>
> You can have your washing, your ironing, and your carpet sweeping, your cooking, your baking, even your sewing, done by electricity. There are on the market electrical machines for washing dishes, cleaning knives, and polishing boots. Almost anything you could expect a servant to do can be done by electricity.
>
> Electricity never grumbles, it is always available, is never sick, never asks for a night off, is equal to the most exacting demands without any reduction in its efficiency; it never asks for a "raise"—in fact, the more you use it the cheaper it becomes; it never fails in an emergency. "When the house has been wired for electricity the foundation of solid comfort has been laid."
>
> May we send a representative to look over the situation and suggest to you how you may use more electricity to advantage?
>
> Yours truly,

The electrical department in Saskatoon is co-operating with the local dealers in a campaign to encourage the use of electricity for household purposes. The rate in Saskatoon for this class of service is 2¼c per kw. hour.

Yours truly,

T. G. McIntosh.

Bell Telephone Service

The Bell Telephone Company are distributing a little folder, entitled "About Ourselves," signed by the general manager, C. F. Sise, Jr., and addressed to the officers and employees of the company. The folder lays particular stress on the importance of efficient and courteous service. It also contains interesting figures regarding the growth, investment, and present proportions of this great company. We reproduce extracts:

"Bell service can remain 'the standard of the world' only so long as each of us as employees strives honestly to make it not only an efficient service, but a courteous and cordial one.

"There is an insistent demand for courtesy, for kindliness, in public service to-day, and that demand must be met.

"Our service to the company should also be an intelligent one—we should all of us be familiar, not only with the company's general rules and regulations, but with the main facts of its business and its position in the life of the community.

"From the annual statement for the year 1916, issued a few days ago, and from other sources, we learn that:

"The Bell Telephone Company of Canada began operations in 1880. It is, therefore, 37 years old.

"Our territory stretches from Quebec City on the east to Windsor and Sault Ste. Marie on the west, approximately 800 miles.

"Our total investment in buildings, plant, and material is $38,844,598.03. The net revenue earned on total investment has never exceeded 10.8 per cent., and the average has been 7.4 per cent., a moderate return to attract new capital, but with no lure for the speculator.

"On December 31st last we had in service 261,899 subscribers' stations.

"Our long distance system comprises 77,599 miles of wire on 9,311 miles of poles, and 4,740 miles of wire in underground and submarine cables.

"There are 812,918 miles of wire, all told, in service, and of this total 476,998 miles, or about 59 per cent., is underground.

"In 45 cities and towns the company owns the buildings it occupies. Our buildings number 98, and represent a value, with the land they rest on, of $3,785,805.

"Employees of the company number 8,698—36 per cent. male and 64 per cent. female— and the annual pay roll totals $4,920,000.

"We have arrangements for interchange of business with 641 independent connecting companies, serving 87,997 subscribers, mostly residents of rural communities.

"The average daily connections on our lines total 2,074,769.

"Our business is a big one, touching the lives of hundreds of thousands every day. Its very bigness means that the obligation on each of us is a heavy one—the obligation to see that our subscribers receive an alert, efficient service, rendered with all courtesy and consideration."

How-I-Did-It?

"How-I-Did-It" is a bright little monthly sales magazine distributed by the Westinghouse Lamp Company. It consists chiefly of little storiettes written by lamp salesmen describing their experiences in placing orders. One of the best in the last issue explains how a prospect with a combination gas and electric system was led to install electricity throughout. We reproduce it herewith. It was written by R. B. Alexander, illuminating engineer of the Texas Power and Light Company, and was awarded the first prize of fifteen dollars:

Sales Strategy Plus Actual Figures

Mr. Prospect owned and personally managed a ladies' medium-sized furnishing store, which was lighted by means of five four-mantle gasoline fixtures fed from a gasoline plant in the rear of the store. The installation was approved by the city fire marshal, and the insurance rate was not higher than it would have been had he been using electricity.

Electric lights were used in the show windows and over the entrance, as well as in the office and in two emergency fixtures, one with 100 watt Mazda B lamps, the other with one 60 watt Mazda B.

On my first two visits I merely talked along general lines, and didn't get very far along towards convincing Mr. Prospect that electricity alone would be better and cheaper in his store than gasoline and electricity combined.

In thinking over the results of these two interviews I came to the realization that I had been doing all the talking, and that I really had received no direct statement from my prospect as to what his ideas of electric lighting were. So I decided to change my tactics, and went around to the store for the third time.

When I entered I was surprised to see a 500-watt Mazda C lamp in an antiquated open fixture hung right in the centre of the store. I congratulated Mr. Prospect on his addition, but told him that it was not a proper installation, inasmuch as the reflector was too flat and was allowing too much of the light to escape to the side walls, to say nothing of the very objectionable glare that met your eye at any angle you happened to look.

Saved Him Money

I played a trump card when I told him that the addition of that lamp, together with the change (recently made) from

60-watt Mazda B to 100-watt Mazda C-2 (daylight) lamps in his windows entitled him to a lower rate, and that I wanted to re-figure his bill for the month just passed. He readily consented to this, and I had our chief clerk render him a new bill that effected a saving of several dollars.

I let this incident "soak in" for three weeks and then I went around with my new line of attack. I decided that the only procedure was to ask pointed questions from the jump and get Mr. Prospect to express himself explicitly so I could take his statements and turn them into arguments in my favor.

"Mr. Prospect, why can't we give you an up-to-date electric installation here in your store " That was my first gun, and it had the very result that I was after. He liked the gasoline lighting; it didn't worry him, as he had one of the clerks look after it, making the replacements of mantles, etc.; it was cheaper than electricity (his gasoline bill for the month was $8), and the only thing against it was the slight inconvenience of using it. As for the cleanliness and air conditions about which I spoke, he had his doubts.

I felt pretty sure that he had played into my hand when he introduced the subject of economy, but I wanted to be certain of my ground; so, after a few irrelevant remarks about business and the weather, I left and made a bee-line for my office.

The Final Attack

From one of my young friends who worked for a clothier whose store we had changed over a year or so past I had learned that their mantle bills had averaged about three dollars a month and that the ceiling had to be re-decorated (conservatively) once every two years. I figured that this cost could, with fairness, be reckoned at an average of $2.50 per month ($60 for the job each two years). I then ascertained from our books that the prospect's electric bill for December totalled $28.56. I compiled these figures, and in a week or ten days went after him again, "armed to the teeth" and with the determination to open fire with a "slap-bang" question that would lead him out.

"Mr. Prospect, all things being equal, wouldn't you prefer electric lighting to your present gasoline system?"

He admitted that he would.

"If I can prove to you that things are more than equal and that I can give you a well-lighted store at a cost for current that will save enough over your present system to pay for an installation of handsome fixtures in from two to three years, are you ready to sign?"

He wanted to be shown, so I produced the final gunshot:

Electric light bill for December	$28.56
New mantles	3.00
Man's time for replacements and cleaning.	3.00
To re-decorating	2.50
Gasoline	8.00
Total	$45.06

"So you see, Mr. Prospect, your combination system of illumination cost you $45.06 for December.

"Now, I have here the current bills of Mr. Smith and Mr. Jones for the month of December for the past three years, and they average about $38 per month, as you see, $7 less than yours. These men, as you know, have stores requiring just about as much light as yours, with windows about the same size. The system I have planned for you will be practically the same as the installations in these two stores, and, as your businesses are similar, you can expect a number of lighting hours fairly close to theirs. You will save $7 per month, or, to be very conservative, $5 a month. That's $60 a year, or $120 in two years. I can put in a first-class installation for less than that. Or, taking it from a purely business point of view, your investment of $120 in this system will draw 50 per cent. interest. Will you sign?"

That's the end of the story. He would have signed a contract to put a battery of flood-lights in the sky to take the place of the moon on dark nights. We put the 500-watt Mazda C lamps in the last of five fixtures provided and three 300-watt Mazda C lamps in the others, using large open, heavy density opal glass reflectors on 4-foot chains. His store is well lighted, and to show him that there were no hard feelings, we took the old gasoline fixtures off the ceiling and stored them free of charge.

The Street Lamp of the Future

The "man on the street" has become so accustomed in recent years to periodic revolutionary developments in electric lighting that it is difficult to make him see that we have now reached a stage where great improvements in efficiency are improbable and, indeed, impossible. For example, we have seen the efficiency of the incandescent lamp grow from three and one-half watts to one-half watt (or less), per candle, and even this degree of efficiency is improved upon in the arc lamp. The trend of the future is noted in an article recently presented by Mr. W. P. Hurley before the N. E. L. A., and the following extracts, having a direct bearon this subject, are interesting:—

The Trend of the Future

Developments in the efficiency of light units in the recent past has been so great that it is not to be reasonably expected this can continue indefinitely. In this connection, it should be particularly noted that comparatively little in this report was accomplished between the first development of the arc and incandescent lamps in the period of 1875 to 1880, and the year 1906 before the advance of the tungsten filament and the flame arc lamp. The future possibilities are, of course, of two kinds—physical and chemical. From a physical standpoint, the temperature is the controlling factor and this apparently is near the limit. In arc lamps, the recent developments have taken advantage particularly of selective radiation—i.e., of chemical properties giving higher luminosity when heated than their incandescent temperature would warrant us in expecting. It is undoubtedly true that this limit has not been reached, particularly as to the flame carbon arc lamps. The flame carbon arc lamps are, however, at the present time, handicapped by the fact that it has so far been impossible to obtain their high efficiencies in any but comparatively large candle power units. This naturally limits their commercial utility. The lamps using magnetic electrodes, have as yet been considerably inferior to the flame arcs for the very high candle power large units.

Field Becoming More Clearly Defined

Consideration of these developments and the present status of the arc and incandescent lamp leads us to believe that there is a field for both types of illuminants which will become more clearly defined as their advantages and requirements are more commonly known. The arc lamp efficiency for large units is unequaled. In common, however, with any more or less intricate mechanism, it requires the care of trained men to obtain the highest utility. This is impracticable where operating conditions are not such as to permit of the retaining of such men.

The incandescent lamps are unparalleled for service where small units are required, or for installation depending upon the services of men devoting the major portion of their time to other work or without mechanical experience. In large units, their renewal cost undoubtedly is greater than the maintenance cost of the modern arc lamp, but this alone is not the criterion.

The development of auxiliary fixtures and control equipment has necessarily shown a corresponding change. The use of series systems must extend greatly as the relatively increased efficiency of series incandescent lamps, as well as the ease of their control becomes better known.

Characteristics of Frequency Changers

With Special Reference to the Induction and Synchronous Types—Discussion of Questions Involved in Their Use

By R. Townend, Assoc. Mem. I.E.E.*

Very little appears to have been written in this country on the subject of frequency changers, and as this type of machine will doubtless receive more consideration in the future than has hitherto been the case—in view of the interest now being taken in the question of the linking up of power stations—a consideration of the various points connected with the use of frequency changers may be of interest to the members of the Institution.

It is not proposed in this paper to consider the problems connected with the use of frequency changers for the purpose of linking up power stations, as this has been done by a paper recently read before the Institution, but to consider the questions involved in the use of frequency changers as electrical machines.

Frequency changers may be divided broadly into three classes:—

1. Where the electrical energy is converted electromagnetically from one frequency to the other (by transformer action).
2. Where part of the energy is converted electro-magnetically and the remainder converted into mechanical energy, and then, in some cases, back again into electrical energy.
3. Where the energy is converted into mechanical energy, and then again into electrical energy.

The first of these types has been described in a paper read before the Institution, but, as the only ratio of frequency conversion obtainable is 1 to 3 (or multiples of this value) its scope is limited. It is to the second and particularly the third type that the author proposes to limit this paper.

The second type usually takes the form of an induction motor mechanically coupled to some form of driving motor. If an electromotive force having a certain frequency is applied to the stator terminals of a slip-ring induction motor, the rotor of which is fixed so that it cannot rotate, the motor operates as a transformer, the slip-ring voltage being determined by the ratio of the number of turns in the stator and rotor windings, and its frequency being the same as that of the stator supply. If the rotor is allowed to rotate, its speed being held constant at any desired value, either by friction brake or by coupling if to a generator, the rotor frequency is reduced and is equal to

$$\text{Stator frequency} \times \frac{(\text{Synchronous r.p.m.} - \text{Operating r.p.m.}}{\text{Synchronous r.p.m.}}$$

If the rotor is rotated by means of a driving motor in the opposite direction to which it normally tends to rotate, the rotor frequency is increased, and is equal to

$$\text{Stator frequency} \times \frac{(\text{Synchronous r.p.m.} + \text{Operating r.p.m.})}{\text{Synchronous r.p.m.}}$$

If we take the case of a supply frequency of 25 cycles, and the rotor is rotated at 140 per cent. of synchronous speed in the opposite direction to which it normally tends to rotate, the rotor frequency is $25 + 1.4 \times 25 = 60$ cycles, and of the energy taken from the rotor 25/60ths is converted by the transformer action and 35/60ths by generator action, the driving motor supplying the power for the latter portion.

If the rotor were allowed to rotate at half synchronous speed in its normal direction, and neglecting the losses in the machine, of the power supplied to the stator 50 per cent would be given out of the rotor at half the stator frequency, and 50 per cent. would be given out mechanically to the direct-coupled machine which now operates as a generator.

With this arrangement it is therefore possible, by using a variable-speed driving motor, to obtain any frequency from zero to a value limited by the maximum safe running speed of the induction motor.

Such a machine appears at first sight to be an almost ideal frequency changer, but it has the great disadvantage of a very poor inherent voltage regulation—the generated voltage falling rapidly with an increase in load, particularly at low power factor (due to the large magnetic leakage between the stator and rotor windings)—and in order to maintain a constant voltage across the secondary terminals of the machine some form of regulating transformer with automatic regulator is necessary.

The machine being of the induction type takes a lagging current from the supply mains, but this can be overcome (provided no variation in the ratio of frequency transformation is required) by making the auxiliary driving motor of the synchronous type and running it over-excited with a leading power factor sufficient to counteract the lagging current taken by the induction machine.

Its bad inherent voltage regulation has prevented this type of machine from being used commercially to any extent, but it is certainly a very useful form of frequency changer for experimental or testing purposes where high-frequency power is occasionally required and the question of voltage regulation is of little importance.

The third type of frequency changer consists of an alternating-current motor driving a synchronous alternating-current generator. The motor may be either of the induction or the synchronous type, the former giving what we will call the induction frequency changer, and the latter the synchronous frequency changer. The generator may be of the induction type, but this is very seldom adopted owing to the well-known disadvantages of generators of this type.

As the motor and generator are not electrically connected together, each machine can be designed for any desired voltage and number of phases, so effecting a change in both voltage and number of phases, in addition to the change in frequency, if this should be required. It is thus possible to obtain single-phase power at a low frequency for traction work from a polyphase high-frequency supply without unbalancing the latter. Also by controlling the generator voltage by means of an automatic regulator, its pressure can be maintained constant independent of variations in either the voltage or frequency of the supply.

Maximum Speed of Operation

The number of poles on the motor and the generator must have the same ratio as the motor and generator frequencies (neglecting the slip in the case of the induction frequency changer), and this, of course, determines the maximum speed for which the set can be designed. Thus a set converting from 25 to 50 periods may have a 2-pole motor and a 4-pole generator, giving an operating speed of 1,500 r.p.m., whereas a set converting from 25 to 60 periods has a maximum speed of 300 r.p.m., corresponding to a 10-pole motor and a 24-pole generator. If, however, it is permissible to lower the 25-period supply to 24½ periods, and raise the 60-period supply to 61¼ periods, a speed of 735 r.p.m. could be adopted corresponding to a 4-pole motor and a 10-pole generator.

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* [illegible] paper read before the Institution.

In the case of the induction frequency changer, the ratio of the two frequencies varies to a small extent with the load, due to the varying slip of the induction motor, and with the number of poles just mentioned an exact conversion ratio of 25 to 60 periods would be obtained at a load corresponding to a motor slip of 4 per cent.

Characteristics of Induction and Synchronous Frequency Changers

The question of whether to adopt induction or synchronous motors depends upon the conditions governing each case. If it is essential that the ratios of the frequencies should be constant at all loads, that the power factor of the motor should be under the control of the operator, or that the set should be perfectly reversible (by perfectly reversible is meant that the motor will operate as a generator without requiring synchronous machines in parallel with it), it is necessary to adopt synchronous frequency changers. Where these requirements do not apply, the induction set has advantages, particularly from the point of view of the operator, as the paralleling of, and load distribution between, induction frequency changers are usually simpler than is the case with synchronous sets.

Where two stations have to be coupled by means of frequency changers, it may be preferable under certain conditions to use induction sets, as they form a connecting link having the nature of a slipping clutch, whereas synchronous sets have the characteristic of a rigid coupling.

Induction Frequency Changers

The motor of an induction frequency changer may be of either the squirrel-cage or the slip-ring type; but where induction frequency changers have to operate in parallel, the slip-ring type is preferable.

Starting.—Starting is effected in the manner ordinarily adopted for induction motors; if of the squirrel-cage type, a low voltage is switched on to the stator terminals, and when full speed is reached the starting switch is thrown over to the full-voltage position; with this arrangement the starting current in the line will be approximately 100 to 150 per cent. of normal full-load current. In the case of the slip-ring motor, normal voltage is applied to the stator terminals, and the resistance connected across the rotor slip-rings is gradually cut out as the motor speeds up. With this type of motor, the starting current will be approximately 30 to 50 per cent. of normal full-load current.

Synchronizing.—Where induction frequency changers have to operate in parallel, the slip-ring type of motor is preferable, as it enables the generator to be synchronized more easily.

Considering the case where a frequency changer running on no load has to be paralleled with a similar set carrying full load, owing to the slip of the induction motor varying directly with the load, the incoming set will be running at a higher speed than the loaded set, and in order that the generators may be safely paralleled it becomes necessary to increase the no-load slip of the incoming set to a value approximately the same as that of the loaded set. If the fully-loaded machine has a slip of 3 per cent. the incoming machine will have a slip of approximately 0.2 per cent. (assuming the resistance of the rotor circuits to be the same in each case), and if the generators have a frequency of 50, a synchroscope connected to the two generators will make a complete revolution in 0.71 second, under which condition safe paralleling is an impossibility. It is therefore necessary to increase the slip of the incoming machine before the paralleling can be effected.

This increased slip may be obtained either by artificially loading the incoming set, or by increasing the resistance of the rotor circuits of the motor. If the motor is of the squirrel-cage type, its rotor resistance is fixed, and it is therefore necessary to adopt the first method in order to obtain the desired slip.

In the case of the slip-ring motor, the second method can be adopted, and is obviously more desirable than having artificially to load the machine. It should be noted, however, that as the motor is running on practically no load, the resistance required in the rotor circuit is considerably higher than is usually supplied for starting the set.

An alternative method which is frequently adopted when paralleling induction frequency changers is to allow the incoming machine to run up to full speed, and when the generator is giving its correct voltage, power is cut off from the motor, and the generators paralleled at the instant the frequency of the incoming generator falls to that of the loaded machine.

Load distribution.—When two or more sets are operating in parallel the load taken by each will depend upon the full-load slip of the different motors, and if a distribution proportional to their relative capacities is desired, each motor must have the same percentage slip at full load.

With slip-ring motors this can be obtained by means of the external resistance in the rotor circuit, but as this precludes the use of brush-lifting and short-circuiting gear, it is desirable that the motors should be designed to have the correct slip with the slip-rings short-circuited.

With slip-ring motors, the load can be distributed as desired between the different sets, but with squirrel-cage motors this cannot be achieved, as each set must carry a definite proportion of the total load, dependent upon its slip at full load.

Reversibility.—The induction frequency changer can transmit power in the reverse direction, i.e., with the induction machine running as a generator, provided there are synchronous machines running in parallel with it, having a capacity large enough to supply not only the wattless current required to magnetize the induction machine, but also the wattless component of the total load on both the induction and synchronous machines.

When operating as a generator, the induction machine must run above the synchronous speed, and as in the case when motoring, the slip varies with the load, equal slips above and below the synchronous speed corresponding to equal outputs as generator and motor respectively.

In order to obtain the advantages of the induction frequency changer, and at the same time to obtain perfect reversibility, two induction sets may be used; one set having a low-frequency induction machine coupled to a high-frequency synchronous machine, and the other a high-frequency induction machine coupled to a low-frequency synchronous machine. A pair of frequency changers of this type has been installed in South Wales to link up two stations generating at frequencies of 40 and 50 periods. The stations were of a capacity sufficiently large to make the adoption of synchronous sets undesirable, but it was necessary that the frequency changers should be able to operate in the case of either station, being unable to supply power. One set consists of a 10-pole synchronous machine coupled to an 8-pole induction machine, and the other set of a 10-pole induction machine coupled to an 8-pole synchronous machine. The combined output of the two sets is 1,000 kw., the k.v.a. output being limited by the k.v.a. capacity of the synchronous machines, owing to the synchronous generator having to supply the magnetizing current of the induction generator in parallel with it, and also the wattless component of the combined output of the two machines.

The induction machines were adjusted by means of rotor resistances to have the same slip at equal loads, and the two sets then worked perfectly well in parallel, automatically supplying load to either system as occasion demanded

Synchronous Frequency Changers

The study of the operation of synchronous frequency changers is considerably more interesting than that of the induction type; the starting and synchronizing is a more complex proposition, and the distribution of load between frequency changers operating in parallel may be a matter of some difficulty.

Synchronizing.—When the motors of two identical synchronous frequency changers are running in parallel, the generator voltages will not necessarily be in synchronism, even assuming both sets to be running light.

We will consider the case of two identical frequency changers A and B converting from 50 to 25 periods, the motors having 8 poles and the generators 4 poles. A is running on no load, and it is required to connect B in parallel with A on both the 50-period and 25-period ends.

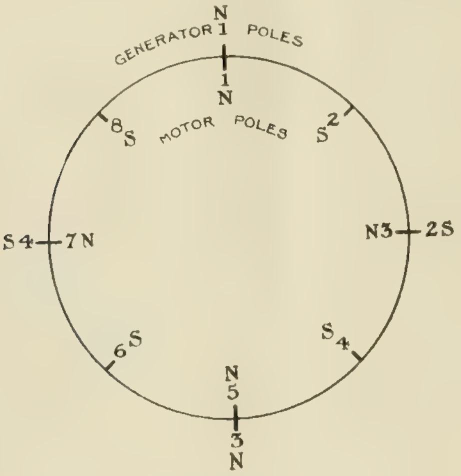

Fig. 1

Fig. 1 shows diagrammatically the positions of the poles on the motor and generator, the radial lines inside the circle representing the centres of the motor poles and the radial lines outside the circle representing the centres of the generator poles.

When the two motors are in synchronism, the N pole 1 of motor B can occupy four positions with respect to the N pole 1 of motor A, viz., positions 1, 3, 5, and 7, but in only two of these positions, 1 and 5, will a N pole of generator B occupy the same relative position as a N pole of generator A. That is to say, with the motor pole 1 in positions 1 and 5, the generator voltages will be in phase, but with positions 3 and 7 the generator voltages will be 180 degs. out of phase. It is therefore seen that with the ratio of frequency conversion under consideration (2:1) the probability of obtaining synchronism between the generators when the motors are in phase is 1 to 2.

If it is found that the genrator voltages are 180 degs. out of phase when the motors are in synchronism, this can be corrected by reversing the excitation of one generator. If the excitation of one motor be reversed, it will be impossible to synchronize the generators, as their voltages will be 90 degs. out of phase.

If the 25-period machines are synchronized first, it will be seen that the 50-period machine voltages must be in phase every time.

If we consider the case of some other ratio of frequency transformation, say 25 to 60 periods, the probability of obtaining correct synchronism of both motors and generators is considerably reduced. With this case the minimum number of poles on the motor and generator are 10 and 24, and Fig. 2 shows the relative position of the centre lines of the poles of the two machines. When the motors are in phase, pole 1 of motor B can occupy positions 1, 3, 5, 7, or 9 with respect to pole 1 of motor A, but only in the case of position 1 will the generator voltages be in phase. We thus obtain one chance in five of obtaining correct synchronism of the generators.

If the 60-period machines be paralleled first, the chance of obtaining correct synchronism is 1 in 12, which may be increased to 1 in 6 if the 25-period machines are fitted with a field-reversing switch.

It will be found that the chance of obtaining correct synchronism is always greater if the low-frequency machines are synchronized before the high-frequency machines, but, as already pointed out, when a set has to be paralleled with one already on load it is an advantage to synchronize the high-frequency machines first, in order to reduce the angle by which the loaded and unloaded machines are out of phase, so reducing the rush of current at the moment of switching in.

Comparison Between Induction and Synchronous Sets

There is very little to be said in the way of comparison between the two types of machines, from the point of view of cost, efficiency, overload capacity, reliability, maintenance, and floor space, as in these respects they are practically on an equality (assuming the same synchronous speed with each type). The type to be adopted must therefore be determined by the other characteristics of the machines, which may be tabulated as given in the table herewith.

It may appear from the foregoing pages that the difficulty and troubles to be experienced in connection with the operation of synchronous frequency changers are sufficiently great to make it advisable to avoid this type of machine if at all possible. The above comparisons and a close consideration of the subject, however, will show that these difficulties are not as real in practice as one would at first expect. If either the motors or the generators are fitted with rotatable stators, the synchronizing and load distribution is as simple, or even simpler, than with induction frequency changers. If the machines have non-rotatable stators, the difficulty of synchronizing depends to a great extent on the ratio of frequency conversion. In this country, the most usual frequencies are 25, 40, and 50 cycles, and with these frequencies the chances of obtaining correct synchronism (taking advantage of the effect of reversing the generator excitation) are as follows:—

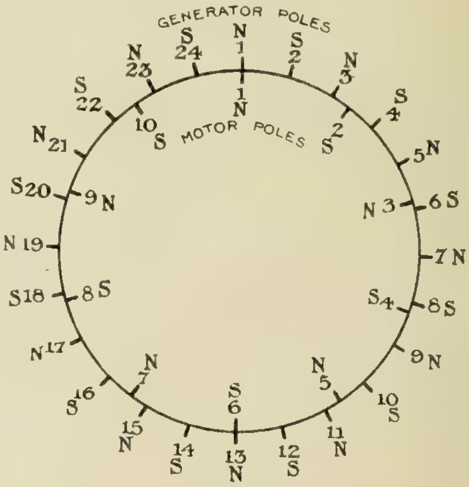

Fig. 2

25 to 40 cycles 1 in 5
40 to 25 cycles 1 in 2
25 to 50 cycles 1 in 1
50 to 25 cycles 1 in 1
40 to 50 cycles 1 in 2
50 to 40 cycles 1 in 5

In any case, the operation of "slipping poles" by revers-

Table I.—Characteristics of Machines

	Induction Type	Synchronous Type
Power factor of motor	Cannot be controlled and always lagging (unless some form of phase advancer is used)	Motor can be designed to operate at any power factor lagging or leading, and is always under the control of the operator.
Reversibility	Reversible only when synchronous machines are running in parallel with the induction machines.	Perfectly reversible.
Ratio of frequency transformation	Varies slightly with the load.	Constant at all loads.
Starting current	Squirrel-cage motor approx. 100 to 150 per cent. of full-load line current. Slip-ring motor approx. 30 to 50 per cent. of full-load line current.	Self-starting motor approx. 75 to 150 per cent. of full-load line current. Separate induction starting motor, approx. 30 to 50 per cent. of full-load line current.
Synchronizing of motor	Does not run in synchronism.	Not necessary if self-synchronizing type of motor is used. Necessary it separate starting motor is used.
Synchronizing of generator	Objectionable with squirrel-cage motor. Not difficult with slip-ring motor.	Simple if stator-rocking gear is provided. Simple, but may take longer if rocking gear is not provided.
Distribution of load between machines	Impossible with squirrel-cage motors Simple with slip-ring motors.	Impossible with fixed stator. Simple if stator-rocking gear is provided.

ing the motor excitation is easily carried out, and will quickly bring the generators into the correct phase relation for paralleling.

Taking all the points into consideration, the advantages of the synchronous frequency changer are sufficient to justify its adoption in the majority of cases.

Scientific Agriculture and the Engineer

Dominion Minister of Agriculture Discusses Their Relation Before the Ottawa Branch C.S.C.E.—Engineer a Doer, Not a Talker

The Hon. Martin Burrell, Dominion Minister of Agriculture, addressed the Ottawa Branch of the Canadian Society of Civil Engineers, Thursday, March 1, on the subject, "Agriculture and the Engineer." The following are extracts from his address, which, throughout, indicated the speaker's appreciation of the value of the engineering profession in advancing that part of this country's development in which he is, officially, most vitally interested. His expressed opinion was that "agriculture and engineering are, of all professions and arts, the most important to the world at the present moment."

"Woefully deficient in engineering knowledge, I have a whole-hearted admiration of the work of the engineer and what it stands for. It has been cynically said that a man with a powerful voice, and rapid utterance, no matter what he says, can attain a high authority in politics. I cannot, of course, be expected to subscribe to such a half truth, but, in any case, the engineer does not achieve authority in this way. He is a doer, and not a talker, and in the long run it is doing and not talking that counts.

"To be an engineer in the best sense of that word a man's whole attitude to his life work must be charged with sincerity, and sincerity is one of the fine things of life. Nature and nature's laws cannot be cheated. Successful achievement is only possible by understanding and co-operating with the eternal laws of the universe. There is, therefore, a continual incentive to clear thought and high endeavor. Difficult problems the engineer must face—as we all have to face, but, in solving them, he has the supreme satisfaction of knowing that his accomplished work abides, a silent and powerful witness that he has not passed through this world in vain.

"And now, Sir, as I have exhausted my time and possibly your patience, I turn to my title, "Agriculture and the Engineer." I warned Mr. Gale that the title was only a compliance with convention. He thought that it seemed necessary to have a title even if you didn't discuss it at all. If directly engineering has little to do with agriculture, indirectly its relationship is vital. It would hardly be too much to say that agriculture and engineering are of all professions and arts the most important to the world at the present moment. As an agriculturist my chief contact with engineering work has been in connection with irrigation. In the large Western district with which I am especially familiar, the work of the irrigation engineer is indispensable to successful agriculture. Water, the conductor of food to the growing plant, and a necessary constituent of the mature plant, whether fruit or vegetable, is a vital factor. In addition to the immense evaporation through plant respiration 40 or 50 tons of water per acre will be evaporated from the soil itself on a warm and windy day. With a rainfall of only 8 to 12 inches per annum, it is easy to see where the irrigation engineer comes in. I bear testimony to the immense value of his services in those districts where I have had personal knowledge of his work, and if I had time I could indicate what you are doubtless familiar with, the vast areas of the world's surface in India, Australia, Japan, the United States and other countries which have been made to serve man's needs to the skill, the efficiency and the integrity of the engineer.

Reducing the Cost of Production

"Undoubtedly the engineer's services to agriculture are incalculable. Without his work in the construction of railroads, bridges and roads, the produce of the agriculturist would be unavailable to man. There are many other ways in which the engineer's services are of immense use; I do not think it is necessary for me to dilate on them. Engineers and agriculturists, we are all aiming at the same things, that is, to produce, and to reduce the cost of production. Your function, perhaps, is more concerned with the latter than with the former purpose. There is an intimate relation between the services that the engineer and the agriculturist can render to the state. When I think of the vast northern country that is familiar to me, all up through Cariboo, for instance, where for something like forty or fifty years men were living and toiling and producing two or three hundred miles away from what we know as a modern system of transportation, and when I come into contact with the people in that region, I get an evidence of what the engineer's work is by the longing they all have for better and easier modes of transportation, and I realize how intensely important the work of the engineer is, even to agriculture. To one who has lived as I have, in British Columbia, the indebtedness to the engineer must be ever present. Again and again as I have travelled through the mountains, at times almost on the roof of the world, looking down from a slender span of steel to the vast depths below, I have paid a silent tribute to the arduous labors and the marvellous skill of the men who had the courage to go out into the wilderness and build those monuments of human enterprise and human activity.

The Importance of Food Production

"I do not think any man who has travelled through British Columbia can help but pay a most unqualified tribute of admiration to the construction engineers who have done that work for the far West. After all, it was something more they did than to build railroads. When the roar of the first Canadian Pacific train was heard through the canyon of the Fraser, it meant not only that a great highway had by engineering enterprise been built, by which people could transport their produce or go from one point to the other; it had a higher, a moral, a national value, in the sense that the work of the engineer was the great work that bound brother to brother and made the solidarity of this people from the Pacific to the Atlantic an accomplished fact. As one realizes not only the strength of the brain and absolute faithfulness of the work which these things involve and which means so much for the country's progress, one wonders whether the material rewards are in proportion compared with those which come to other forms of human activity. I doubt whether they are. 'Five thousand a year to your talker and a shilling a day to your fighter, digger and thinker,' says Ruskin. You are familiar with that fine passage of his in which he deals with the question of work and material rewards. He has truly said that with all brave and thoroughly trained men their work is first and fee second, important always but still second. If your work is first with you and your fee second, work is your master and the Lord of work who is God. If your fee is first with you and your work second, fee is your master and the Lord of fee who is the Devil. It is to the honor of the engineers especially that in their great services to their day and generation they are not fee-first men. They are men who take a pride, a legitimate pride, in their work, who do their work with a full sense of their obligation in regard to their fellow men, and we do indeed recognize the debt we owe them and the extraordinary reliance which we place on the efficiency and on the integrity of their work.

"I said in the earlier part of my remarks, that agriculture and engineering were probably the two most important industries contributing to the world's needs to-day. This war is a great struggle for the perpetuation of civilization and humanity as we understand it, and for democracy as we live under it, and I say again, advisedly, that those two arts, professions, or sciences, or whatever you choose to call them, stand out as being the most conspicuous factors in respect to the success of the battles which we are waging for our common liberties. Agriculture perhaps had not in the earlier stages of the war the attention paid to it that it deserves, but as the days go by, we find that the war may yet be won by the terrific and increasing pressure and strain under which the people of Germany and of Austria will be fighting or living, or trying to live, before another harvest comes in. When things have already in those countries reached the stage where the ration for the civil population amounts to an average of only 1,100 calories a day, though an ordinary person, such as myself—not an engineer—a person who does not work physically very hard, requires at least 2,000 calories a day, and a strong workingman requires between 3,000 and 4,000 a day, we know something of the fierce strangle-hold that the British navy is exercising on that nation, and we know the importance, the vital importance, to that country of the production of food. We know it almost as much from the other countries. Switzerland for the last two years has been practically living on a cheap and coarse form of grey bread. Holland is feeling such a pressure that while people in this country are decrying the high price of food and asking for relief, the people of Holland are facing prices that we know nothing about. When England to-day is under such a shift that she is ploughing up her beautiful parks, is enlisting the services of women, and disabled soldiers, in the determined effort that if her supplies are cut off, or partially cut off, she may produce more than she ever produced before, we can understand the part that agriculture is playing in this war. But engineering is playing no less vital a part, for without the services of the engineers the advance and the achievements on the western front, or on other fronts, would have been absolutely impossible. We may say almost that this is a war of science and invention. The methods of old-time battles and old-time wars are long passed out of existence, and modern skill, modern ingenuity, modern brains are essential. Those of the engineers have been called into requisition and will unquestionably play a leading part in the triumph which sooner or later must come. I can only say, in sympathizing with and in congratulating you upon the contribution which your own Society has paid, by the heroic sacrifices that your members have made in direct participation in this war, that there remains for us who are staying behind, who have not gone, whether we be engineers or whatever be our calling and our work in life, there remains for us the supreme duty of doing all we can to strengthen the hands of those who are fighting our battles, and to build up this nation along true and permanent lines. And in such work, Mr. Chairman, I am absolutely sure that the engineers of Canada will play their part."

Laurentide's First Annual Report

According to the first annual report of the Laurentide Power Company, the gross revenue was $375,381; the operating expenses were $25,443, maintenance $1,885, and general expenses $12,432; total, $39,760. Interest on bonds absorbed, $313,681, less $162,500 charged to construction. Of the credit balance of $154,111, $100,000 was transferred to reserve and the balance of $54,111 credited to contingent account.

The Work of the Advisory Council for Scientific and Industrial Research in Canada

By Frank D. Adams, F.R.S.*

One of the most remarkable and perhaps unexpected results of the great war is that there has been in every country of the English-speaking world a sudden awakening to the importance of scientific research, and a recognition of the necessity of applying it to the whole range of problems which present themselves in both war and peace.

The reason for the awakening is quite a simple one—"The Hun is at the Gate." Great Britain developed as an industrial nation long before Germany had achieved any success in this sphere of effort, and the British system of manufacturing and her industrial expansion was developed by the independent and competitive efforts of a multitude of relatively small enterprises built up on the basis of the artificer and trader and in methods of the olden times. In the last decades, however, Germany having realized her national existence through successful war based on study and good organization became possessed with the idea that she could become equally successful by the application of similar methods to the more insidious warfare of industry and trade. The note of her success was, as has been said, knowledge and organization, both national extent. By knowledge obtained through research on a most extended scale and by wise organization of all her powers she proceeded to take from the other nations one after another of the productive industries. From the earliest times woad was cultivated in England. It constituted, we learn from the popular histories of England, in these times a not inconsiderable part of the national dress. With the opening up of trade with the East, the European dye could not hold its own with the cheaper indigo obtained from the Indian plantations, and these until recently controlled the markets of the world. The German chemist Adolf von Baeyer, however, in 1880 found that indigo could be made synthetically from toluene. What was the result? In 1896 India exported indigo of the annual value of over £3,500,000. In 1915 her exports of this dye were worth about £60,000, while the export of indigo from the German factories was valued at about £2,000,000. Moreover, in the above period the price of indigo fell from about 8s to about 3s 6d per pound.

Forty or fifty years ago over the whole of southern Europe and eastwards to Asia Minor great tracts of land were devoted to the growing of the madder plant. In France alone 50,000 acres were devoted to its culture. From it was made the bright red dye still known as Turkey red. These madder fields have now all disappeared, for the chemists now make it cheaply, and instead of 750 tons of alizarin extracted from madder roots in 1870, over 2,000 tons are now annually manufactured in chemical works.

The glass industry of Great Britain was stolen away slowly but in a large part. At the outbreak of the war there was being made in England only a couple of dozen kinds of optical glass, while over one thousand were being made by our enemies. It was found, in fact, that the very sighting glasses of the British battleships were made of German glass. Many new industries such as the promotion of the great variety of new chemical compounds used for various purposes in industry, arts and medicine, were also built up and secured as complete monopolies by the Germans.

The Dye Industry

The most spectacular case of the transference of an English industry to Germany is afforded by the great aniline dye industry. The method of making these aniline colors was first discovered by an English chemist, Perkins—and the manufacture was actually started in England, but was gradually taken over by the Germans and developed to its present enormous dimensions, yielding annually about £20,000,000 sterling, so that at the outbreak of the war it was found that England was hardly producing one tithe of the various dyes needed for her textile industries which have an annual output valued at £250,000,000.

This successful competition, however, was not confined to such products as those mentioned, for in 1895 Germany passed England in the production of steel, and with this advance came the immense development of the manufacture of iron and of machinery of all kinds and sorts. This devastating war, the hand to hand struggle for the actual right to live, has, however, at length aroused Britain to the realization of the fact that we have reached a new age, and the old cannot compete with the new. Now it is the application of science to industry and the organization of the activities of life that tell the—nation which does not recognize this must fall out of the race. "War," as remarked by Sir Wm. McCormick, "is as much an art as ever, but its instruments, originally the work of the craftsman and artist, are now not only forged by the men of science, they need scientific training for their effective use. This is equally true of the weapons of industry. The brains, even the very processes that to-day are necessary to the output of munitions, will be needed to-morrow for the arts of peace."

Committee of the British Privy Council

The Government of Great Britain having been brought to a realization of these facts appointed within less than a year after the declaration of war a Committee of the Privy Council for Scientific and Industrial Research, with an advisory committee composed of eight distinguished men of science and engineering "for the development of scientific and industrial research" applicable to the problems of war and the development of the industries of peace to follow the war. This committee has been at work since that time with very marked success. The Government of Australia followed, establishing a "Commonwealth Institute of Science and Industry" on similar lines. New Zealand and India have also expressed a desire to co-operate with the Imperial Government in any possible way. The United States has engaged in a campaign for "Preparedness." No less than three separate organizations have come into existence in that country to this end. The Naval Consulting Board, the National Research Council, which was organized under the authority of the President of the United States of America, by the National Academy of Science, and the Committee on Scientific Research of the American Association for the Advancement of Science. A good deal of opposition has been offered on the part of certain Congressmen to the appointment of any government committee for the purpose of "Research" or "Investigation," owing to the fact that the only use of the words with which they are familiar suggested something malodorous and reminiscent of muck-raking, accusation and scandal.

Committee of Dominion Cabinet

Coming to our work in Canada, on June 6th, 1916, a Committee of the Privy Council, consisting of the Right Hon ourable the Minister of Trade and Commerce (Chairman), and the Honourable the Ministers of the Interior, Agriculture, Mines, Inland Revenues and Labour, was formed by the Privy Council to take charge of all measures "to further the scientific development of Canadian industries in order that during and after the war they may be in a position to supply all Canadian needs and to extend Canadian trade abroad."

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*Before Canadian Mining Institute.

The Advisory Council and its Duties

On November 29th, 1916, there was constituted under this Committee of the Privy Council an Honorary and Advisory Council for Scientific and Industrial Research, composed of eleven members representing the scientific, technical and industrial interests of Canada. This Advisory Council was charged with the following duties:

(a) to ascertain and tabulate the various agencies in Canada which are now carrying on scientific and industrial research in the universities and colleges, in the various laboratories of the Government, in business organizations and industries, in scientific associations or by private or associated investigators.

(b) To note and schedule the lines of research or investigation that are being pursued by each such agency, their facilities and equipment therefor, the possibilities of extension and expansion, and particularly to ascertain the scientific man power available for research and the necessity of adding thereto.

(c) To co-ordinate these agencies so as to prevent overlapping of effort, to induce co-operation and team work, and to bring up a community of interest, knowledge and mutual helpfulness between each other.

(d) To make themselves acquainted with the problems of a technical and scientific nature that are met with by our productive and industrial interests, and to bring them into contact with the proper research agencies for solving these problems, and thus link up the resources of science with the labor and capital employed in production so as to bring about the best possible economic results.

(e) To make a scientific study of our common unused resources, the waste and by-products of our farms, forests, fisheries and industries, with a view to their utilization in new or subsidiary processes of manufacture and thus contributing to the wealth and employment of our people.

(f) To study the ways and means by which the present small number of competent and trained research men can be added to from the students and graduates of science in our universities and colleges, and to bring about in the common interest a more complete co-operation between the industrial and productive interests of the country and the teaching centres and forces of science and research.

(g) To inform and stimulate the public mind in regard to the importance and utility of applying the results of scientific and industrial research to the processes of production by means of addresses to business and industrial bodies, by the publication of bulletins and monographs, and such other methods as may seem advisable.

It will be observed that this is not another Commission, but an Advisory Council.

The Council has thus been in existence but three months, and has devoted this time, in addition to developing its organization, to a careful study of the wide range of problems coming under its purview.

Careful Consideration of Each Subject

It was found that there were certain matters which could and should be taken up at once. On these the Council at once proceeded to act. Others were subjects which required more careful thought and longer study, since it was of vital importance that no mistake should be made through precipitated action leading to false steps which would have to be retraced.

The matters on which the Council has already taken action are the following:

(1) It has drawn up and has had printed four sets of questionnaires for distribution to the following:—

(a- The managers and directors of Canadian industries.

(b) The members of scientific, professional and technical societies.

(c) The universities of the Dominion.

(d) The Government Departments both Dominion and Provincial.

These questionnaires are now being distributed and the Council wishes to acknowledge the very active co-operation which has been extended to it by the Manufacturers' Association and by the great technical societies of the Dominion in connection with securing full and careful returns in the case of the first two sets of questionnaires.

From the answers to these questionnaires the Council will obtain the information required for the completion of the studies set forth under heads (a) and (b) and to a certain extent under head (d) in the schedule given above.

(2) It has advised the Government, in order to encourage research, to establish twenty studentships each having a value of $600 to $750 per annum, and several scholarships each having an annual value of $1,500 at the universities or technical colleges of the Dominion. These will be given to men carefully selected for the promise and capacity which they have shown in the prosecution of research work.

The Council aims at training through these studentships and scholarships a body of men such as is to be found in Germany, France, or the other countries of Europe, who are fitted to undertake research and obtain results, and who will be available for such work in connection with the industries of the Dominion. Relatively few men of this class are now to be found in Canada.

(3) The Council have recommended to the Government that assistance be given to the Provincial Government, local industries, or other recognized bodies, should they desire to establish local institutes or bureaus for industrial research at important industrial centres in Canada. This aid is to be given only when the local bodies have themselves subscribed sums of money sufficient to ensure the successful prosecution of the work when aided by the Government, and such grants are to be made only when the plan and work of the proposed bureau has been carefully examined and approved of by the Council.

(4) The Council is also completing a very careful study which has been taken up in connection with the officers of the Federal Department of Mines as to the possibility of producing a suitable supply of good cheap fuel for the eastern plains, more especially in the provinces of Saskatchewan and Western Manitoba. While the high price of coal is felt in all parts of the Dominion it is a very serious menace in this region, since at the present time all the coal used there must be brought either from the Rocky Mountains or from distant points in the United States. If these investigations, which will be completed within the next three or four months, confirm the evidence which is now in hand, the Council will recommend that the Government put up a trial plan on a commercial scale for the manufacture of such fuel by the carbonization and briquetting of the lignites which underlie great areas in the eastern plains and which do not themselves supply a satisfactory fuel. It seems from the evidence now in hand that a good high grade fuel suitable for domestic purposes can be produced from these lignites at a comparatively low cost. It is proposed by the Council to have this matter tested to a final and definite conclusion by the

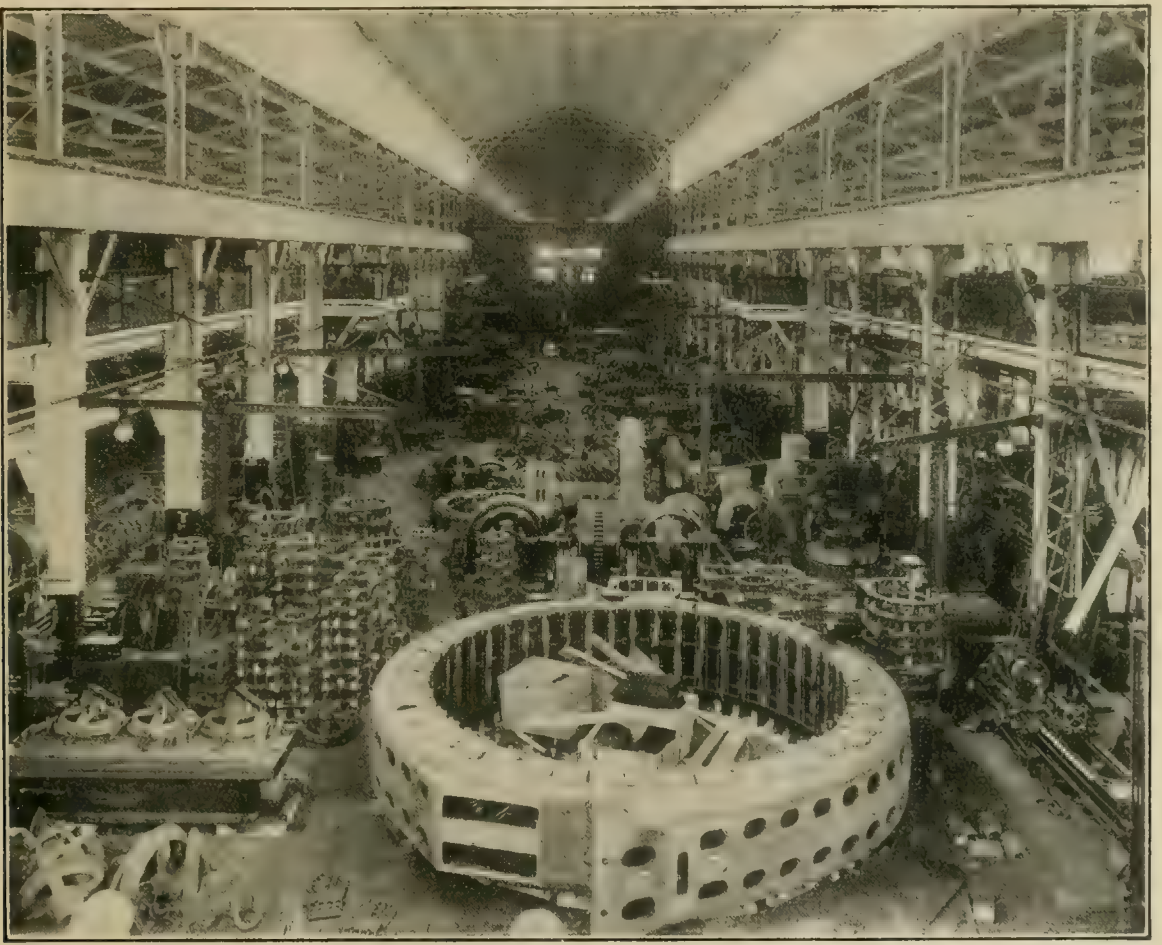
(Concluded on page 35.)

C. G. E. President Banqueted at Peterboro

The Hon. Frederic Nicholls, president and general manager of the Canadian General Electric Company, was the guest of honor at a banquet on March 29, tendered to him by the citizens of Peterboro. Mayor J. J. Duffus presided. The banquet was attended by all the prominent business and professional men of the city, who eagerly did honor to the man who has worked so hard to make the name of Peterboro known, as a manufacturing centre, throughout the commercial world.

Senator Nicholls, in addressing the guests, made happy reference to the pleasant relations that had existed for nearly twenty-five years between the city and citizens of Peterboro on the one hand and himself and his company on the other. He spoke of the rapid expansion of the electrical industry in general and the Canadian General Electric Company particularly during this comparatively short period, and expressed the belief that, with the war's ending, further additions to their already extensive plant would be necessary.

Mr. E. G. Patterson, superintendent of the Peterboro works, occupied a seat at the left of the chairman. The photo herewith shows a recent view of the interior of the main electrical shop of the Peterboro works.


Interior view of the main electrical shop of the Peterboro Works of the Canadian General Electric Co.

R. E. T. Pringle, Ltd., are distributing an attractive folder giving a quantity of interesting and useful information about the "Dumore" sewing machine motor.

Personal

Mr. Frank Kennedy has been appointed Toronto manager of the Bell Telephone Company. He has acted as assistant manager since the appointment of Mr. Dunstan as manager of the Ontario division.

Mr. Harry C. Brown has been appointed secretary of the National Electrical Contractors' Association and business manager and editor of the association's official journal, the National Electrical Contractor, succeeding Mr. George H. Duffield. Mr. Brown will be in charge of the N. E. C. A. headquarters office, 41-2-3 Martin Building, Utica, N.Y. He was previously assistant secretary of the association.

Mr. George H. Olney, his many friends will regret to hear, on the advice of his medical advisor, has decided to relinquish his active connection with the Eugene F. Phillips Electrical Works, Limited, Montreal, which owes its success in the last twelve years solely to the personal efforts of Mr. Olney. His ability and personality have won for him the esteem and respect of the entire Canadian electrical fraternity. Although Mr. Olney is resigning his position as managing director and treasurer of the company, they will still have the advantage of his experience, as he will retain his financial interest in the company and keep his seat on the directorate.

The Dealer and Contractor

Factory Lighting—Its Economic Value—Is it, or is it not, worth while to light rooms and machinery correctly and well?

By Prof. C. E. Clewell, before I.E.S.

In May, 1910, Prof. Charles F. Scott, Sheffield Scientific School of Yale University, in an editorial in the Electrical Journal, made an analysis of the costs of factory lighting in terms of wages, thus emphasizing a new point of view in the consideration of industrial lighting. In the years following it has become quite common to evaluate factory lighting costs to an equivalent proportion of the wages of the employees who use the light, as one of the best ways of expressing the advantages of good light in factory work.

Any factory executive or manager should take an interest in these factors which may influence, for good, the production rate of his plant, provided the matter is put up to him in a convincing manner; and he will be found, in many cases, to accept as a working basis for the value of the best lighting to his plant the return in quantity and quality in production resulting directly or indirectly from the expenditure for a modern system of lighting to replace an old and an inadequate system.

The value of adequate factory lighting may thus be reduced in a simple manner to such items as the time it saves the employees in the performance of their regular work, the improved accuracy it makes possible in workmanship, the protection and safeguarding of the eyes of the workmen, the beneficial effect of bright and cheerful surroundings on the temperament of those affected, and the tendency it has to reduce accident hazzard.

If, therefore, in summarizing the advantages of good factory lighting, in contrast to inferior lighting conditions, the cost of improved light be evaluated to the equivalent time saved the employees in the general run of their work, it will be found that the wages thus saved are usually materially greater than the cost of the lighting, and the net saving to the plant, either through reduced wages for the same output or in larger and better output for given wages, due to improved lighting, is just as definite and important an asset to the plant as is a new machine tool which, due to its higher efficiency in contrast to an older machine, is capable of effecting a similar economy.

As a starting point, therefore, it is desirable to assume toward adequate factory lighting an attitude of such a nature as to class it as one of the economies in industrial management; and, rather than to place too much emphasis on the cost of the different available types of lamps or on the various systems of lighting, to concentrate the major part of the attention on the improved quality and quantity of workmanship which may be expected to accompany better lighting. In brief, it is well to think of lighting as an asset to the plant, and when deciding on the type of lamp to install, to consider which type is best suited to the needs of the factory, rather than to direct all attention, as is so often the case, on those relatively small differences in first cost, which sometimes lead to a selection of the cheapest rather than the best.

As a matter of fact, the past five or ten years have witnessed widespread improvements in many factories where the prevailing former conditions were very poor, and a typical factory manager of to-day, whose sections are equipped with modern lighting, is able to take a certain pride in the improved appearance of the surroundings, and at the same time he has the assurance that the accompanying improved workmanship and sentiment of his employees represent material returns in excess of any outlay he may have been called upon to make for the improvements in question.

As obvious as these indirect advantages may seem to be, they are not as satisfying nor are they as useful in the practical advancement of better lighting conditions in the industries as would be the case were there more definite examples of cash returns available due to improved light, or were there on record actual numerical percentages or increases in output due to the same cause. The need for such definite information is made evident in a statement by Dean A. J. Rowland, in a discussion on the subject of factory lighting several years ago, a part of which I quote herewith:

"There is one very important detail of industrial lighting which seems to have been given but little attention by anyone; that is the accumulation of data which will give the answer to this question: Is it or is it not worth while to light rooms and machinery correctly and well?

"Such questions are as important as any which can be considered in connection with industrial lighting. The kind of lights used, their arrangement, the kind of shades put on them, are insignificant matters compared with the money value of good light to the industries. This will have to be determined somehow if industrial lighting is to come into its own."

This quotation from Dean Rowland's discussion is merely given as typical of this impression which prevails that such data is badly needed; and, while this need is generally recognized, the data desired is very difficult to obtain.

From the manufacturer's point of view, the cost of the annual operation and maintenance of the illumination of a typical factory bay of 640 square feet area may be taken at $50 under certain assumptions as to energy cost, cleaning, interest, and depreciation. If five workmen are employed in such a bay at an average of, say, 25 cents per hour, the gross wages of the men in such a bay, plus the cost of superintendence and indirect factory expense, may equal from $5,000 to $7,000 per annum.

In a case of this kind, therefore, the lighting will cost from 7/10 to 1 per cent. of the wages, or the equivalent of less than the wages for from four to six minutes per day. We may roughly say that a poor lighting system will cost at least one-half this amount (sometimes even more through the use of inefficient types of and a poor arrangement of lamps), or the equivalent of the wages for from two to three minutes per day. Nearly all factories and mills have at least some artificial light, hence, in general, if good light enables a man to do better or more work to the extent of from two to three minutes per day, the installation of good lighting will easily pay for the difference between good and bad light, through the time saved for the workman.

The foregoing discussions and quotations are typical of the viewpoints which have been assumed in recent years towards the field of industrial lighting, on which the following advantages of good light may be based

1. Increased production for the same labor cost.
2. Greater accuracy in workmanship.
3. Reduced accident hazard.
4. Avoidance, or at least reduction, of eye-strain.
5. Surroundings made more cheerful.
6. Work performed with less fatigue.
7. Order, neatness, and sanitation promoted.
8. Superintendence rendered more effective.

In other words, factory lighting is important to production; its cost is small in comparison with its advantages; and when its cost is interpreted or reduced into the equivalent wages saved through its adoption, the expenditure for the best lighting is usually a very small item by contrast.

The principal requirements which should be met fully in planning factory lighting may be summarized as follows:

I would head the list with sufficient intensity of general illumination over the floor area to prevent accidents and to make it possible to handle material and to get around the machinery readily.

Second. Sufficient intensity of the illumination at the point of work, usually a higher intensity than in the first, although it is practical in some cases to make the intensity of the general illumination adequate for both the first and second. Now I, myself, believe that, in general, you can combine these two, and you can make general illumination sufficient to enable you to do the work in both.

Third. The use of suitable shades and reflectors, with the lamps mounted in such positions as to avoid eye-strain.

Fourth. The electric circuits and gas mains of sufficient size to assure working pressures of the supply at all times.

Fifth. In addition to the fourth, the supply would be adequately protected against interruption of service.

Sixth and final. The size of the lamp should be in accord with the ceiling height of the section where it is employed, particularly where the entire illumination is furnished from lamps overhead—that is to say, where no individual lamps are used close to the work. In other words, if you have low ceilings, use small lamps, and for high ceilings, lamps of greater wattage.

As pointed out in a recent paper by L. B. Marks, legislation on lighting is so meagre and scattered, and apparently so little called for in this country that no legislation bureau has found it worth while to collate it. Mr. Marks pointed out that five years ago (1911), based on an extended review of factory legislation under the direction of Prof. John R. Commons, and reported by E. L. Elliot, there were only eleven states that made any mention of the subject of light in their general factory or labor laws, and in not one of these were the provisions sufficiently specific to render them of practical value.

Since that time factory lighting legislation has received attention in several states, the most prominent cases being Wisconsin, New York, and Pennsylvania. Briefly stated, the legislation in both Wisconsin and New York, while a step forward in each case, has been rather indefinite, mainly because in neither case are the requirements specific with regard to the illumination at the point of work.

Following the legislation in these two states, two important new developments have been made in this direction. The one has been the publication in 1915 of a code for the lighting of factories, mills, and other work places by the Illuminating Engineering Society, as a result of the work of several of its committees, and the other the first report of the Department Committee on Lighting in Factories and Workshops, issued also in 1915 in London.

Following the completion of the I. E. S. code, representatives of the labor departments in Pennsylvania and New Jersey met with a committee of the I. E. S. and, on June 1, 1916, as a result of these conferences, the Department of Labor and Industry in Pennsylvania, John Price Jackson, commissioner, adopted the I. E. S. code in slightly modified form. Pennsylvania, by this action, becomes the first state in this country on record to adopt a factory lighting code based on definite intensities of illumination on the work.

This shows us that there is a great work to be done yet, and I for one am anxiously waiting the time when our own state shall take up the work. If any state needs it we do. I do not know what percentage of our factories are adequately lighted, but I am sure it must be very small.

British Columbia Association of Electrical Contractors and Dealers Hold Another Successful Luncheon.

One of the most successful midday gatherings held under the auspices of the above association took place at the Hotel Grosvenor on Tuesday, March 20. To the number of forty the members sat down to luncheon, under the chairmanship of Mr. J. F. Little, sales manager Northern Electric Company. Following a sumptuous repast, Mr. Little announced that Mr. Bollschweiler, superintendent of plant of the British Columbia Telephone Company, had been asked to address the meeting, but the latter had thought that the members would be more interested if, instead of making a set speech, he invited them to go over the premises of the telephone company; he therefore proposed an immediate adjournment, and suggested that on arrival at the exchange the members should divide themselves into groups and he and eight members of the staff would give them an interesting half-hour. This proposal was very acceptable to the gathering, and in a few minutes the members were busy asking various questions in different parts of the exchange. The members of this association are all agreed that such gatherings do much to help the get-together spirit which is now very strong on the Pacific Coast.

Forming Advertising Service Co.

Mr. C. W. Forbrich, Western manager of the Electrical Review and Western Electrician since 1908, has resigned his position to enter the advertising field on his own account. He has formed the Forbrich-Burton Advertising Service, Inc., Monadnock Block, Chicago, whose object will be to give selling co-operation, to place trade paper and magazine advertising and design, and write advertising literature of all kinds for electrical, mechanical, and other manufacturers. Mr. Forbrich's partner, J. H. Burton, who was also formerly connected with the Western Electrician, is well versed in creative advertising, and for the past few ears has had charge of the service department of "Practical Engineer." Messrs. Forbrich and Burton's combined experience of nearly forty years in electrical and mechanical advertising should fit them to render a most valuable service to their clients.

Trade Publications

Panel Boards—bulletin by the Crouse-Hinds Company of Canada, describing a new type of Multimeter Panel developed to meet the growing demand for panels which can be installed in large office buildings, warehouses, and apartments where electricity is supplied to tenants through separate meters.

The Toronto Electrical Contractors' Association

Is the Name—Organization Completed—Members Unanimous—Kenneth A. McIntyre the First President

The electrical contractors of Toronto met on Wednesday, April 4, at the Carls-Rite Hotel, and formed themselves into the Toronto Electrical Contractors' Association. The committee on organization, appointed some time previously, had drawn up a constitution and by-laws which were submitted to the members present and considered clause by clause. Of eighty members on the mailing list, sixty-nine indicated their interest by returning the question card that had previously been sent out, and the forty odd contractors who were present at the dinner were unanimous that the opportune time had arrived for the formation of a new association.

The constitution and by laws are modelled very largely on those of the National Electrical Contractors' Association of the United States. The officers of the association consist of a president, vice-president, and secretary-treasurer, who, with two additional members, form an executive committee. The association includes as its members bona-fide electrical contractors only, and the term "electrical contractor" is clearly defined.

The by-law provides for an initiation fee of $15 for all applications received before July 1, 1917. After that date the fee will be increased. The annual dues were placed at $15. Meetings will be held monthly, probably in the evenings, and on such dates as the executive committee shall decide following a written vote of the members.

It is indicative of the keen interest taken by the members of the new association that about three-quarters of the cheques, covering the initiation fee, were received from members present before the organization meeting broke up.

What is an Electrical Contractor?

According to the constitution of the Toronto Electrical Contractors' Association, the term "electrical contractor" shall include all persons, firms, or corporations carrying on the business of installing electrical apparatus for incandescent and arc lighting, and the installation of all electrical machinery, wiring, and switchboard construction used by or in connection with electric lighting, heating and power services, and other branches of electrical supplies, such forming the principal and fundamental portion of their business. The executive committee are required to pass upon all applications.

Robert Knight Joins A.S.C.

Mr. Robert Knight, assistant superintendent of the Edmonton Electric Light and Power Department, and previously superintendent of the street railway, has sent in his resignation and joined the Canadian Army Service Corps. Mr. Knight has been in the Electric Light Department since 1911; is a native of Dundee, Scotland, took up the profession of electrical engineering in Boston, and is a member of the A.I.E.E. Employees and office staff of his department presented Mr. Knight with a handsome wrist watch and address expressing the regret they will feel as a result of his action, and, at the same time, admiration.

The electric pole climbers of Quebec city are on strike and considerable damage has been caused by cutting wires and interrupting the service.

Before organization. Electrical contractor arriving at Carls Rite.

C A R L
MY! BUT HES GROWN IN THE LAST COUPLE OF HOURS
(AFTER)
JOE

His opinion of himself undergoes a considerable change

What is New in Electrical Equipment

The Spraco Cooling System

During the summer of 1914 the Spray Engineering Company of Boston, Mass., installed one of their Spraco cooling systems in connection with an installation of Canadian General Electric steam turbo-generators at the Bennett Ave. plant of the United Last Co., Ltd., Maisonneuve, P.Q. This installation consists of a concrete pond 64 feet long by 45 feet wide, inside measurements, surrounded by a louvre fence, and having forty two-inch bronze turbine spray nozzles with a total capacity of 1,600 gallons per minute, arranged in connection with a piping system over the pond. The entire work, including excavation, pouring of concrete bottom and side walls, as well as piers for supporting suction well, necessary expansion joints, erection of fence and pipe with special equipment was carried on completely by the Spray Engineering Company under charge of one of their erecting engineers.

The forty nozzles were arranged in eight groups of five each by means of the special spray heads and spray arms used by the company in their standard installations. The bottom slab of the pond was 6 inches in thickness, sloping towards the suction well. The depth of water in the pond varied from 3 feet at the suction well to 2½ feet at the opposite end of the pond. The pressure carried at the nozzles varies from between six pounds and seven pounds during hot weather, to considerably less than four pounds during winter weather.

Although this company had operated a number of ponds in the New England States during the previous four years, with no difficulty from freezing during extremely cold weather, still, the temperature never went below 15 degrees below zero, and, as the temperature of the air in Montreal goes considerably below this point at times, it was thought best to supply a special feature in this case to prevent possible difficulty from formation of anchor ice in the pond around the intake screen when the temperature of the air is in the neighborhood of 30 degrees below zero. Hence a 4-inch bleeder was arranged so that it could be opened more or less as required, admitting a small amount of hot water directly from the condenser, thus enabling them to maintain the temperature of the water in the pond between 35 degrees and 40 degrees, no matter how low the temperature of the air might go. This device proved to be very successful and no difficulty whatever has been experienced from formation of ice in the pond.

Interior view of Spray cooling pond.

After this pond had been in operation two winters and one summer, the United Last Company advised the Spray company that they were able to cool water to a temperature of 80 degrees F. with air at 94 degrees F. and maintain 28-in. vacuum under these conditions, which is a very satisfactory result for both parties concerned. They also stated that there were no leaks in the pond, and that the entire installation had proved to be satisfactory in every way. The Spray Engineering Company now has five or six additional installations in Canada, between 250 and 300 in all parts of the United States, three in Mexico, thirty-five in Cuba, and one each in Porto Rico, South Africa and China. The "Spraco" System, as compared with cooling towers, is claimed to require less power, less make-up water, have longer life and lower first cost. For electrical plants both the air and the water cooling systems of the company appear to have a promising future. The control of generator and motor temperatures working anywhere near capacity requires a very large amount of cool, clean air. The same is true of the water requirements of our larger steam turbines and transformers.

Exterior view of cooling pond.

An Electric Outboard Motor

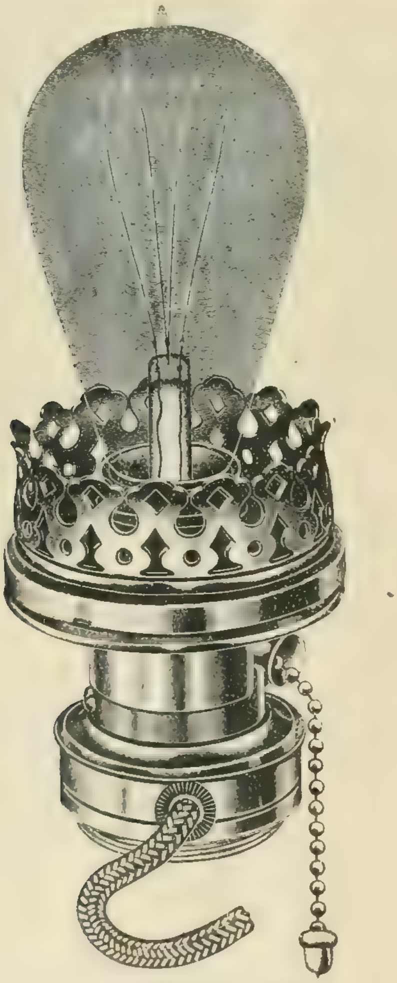
The electric motor boat has always met with favor on account of its noiseless working and cleanliness; where high speed or wide range of action is not demanded or for duck shooting or trolling the electric is ideal. The outfit described below is manufactured by the Jewel Electric Company, Chicago.

The motor is placed directly above the main driving shaft, which is contained in a telescopic tube, allowing the propeller to be adjusted to the correct distance beneath the surface of the water. The propeller is driven through a modified type of worm gearing, which gives a great reduction between the motor and the propeller, this being necessary owing to the fact that the normal speed of the motor is about 3,000 revolutions per minute. Above the motor is a small steering wheel, which enables the propeller to be turned to the right or left hand, or completely round if it is desired to reverse the direction of the boat. To this wheel may be fitted either tiller or steering yoke according to requirements. The outfit is made of aluminum, and manganese alloy wherever possible, the idea being to reduce the weight. The motor complete, without battery, weighs only 50 pounds. The motor operates on a current of from six to twelve volts.

By means of a simple device the motor may be detached from the driving shaft and used for other purposes. The standard storage batteries supplied with the regular equipment are two of 6-volt, 120 ampere each. Arrangements are being made for agents and territory rights in Canada.

Converting Oil Lamps to Electric

The illustration shows the Ideal electric converter now being marketed by the Plume & Atwood Manufacturing Company. This converter, as its name implies and the illustration shows, is designed for the conversion of oil lamps into electric lamps, without changing the appearance of the lamp itself. There are innumerable oil lamps throughout the country which, for economic or sentimental reasons, their owners would prefer to continue in service. The Ideal converter makes this possible at small expense.



Converter with pull-chain socket.

By large majorities of votes, personal and property, the citizens of Sherbrooke, P.Q., have carried the by-law in favor of purchasing the Two Miles Falls power near Weedon. The by-law authorized the raising of $375,000 for this purpose. There was a majority in every ward except one. In order to transmit the power to the city it will be necessary to build a transmission line, and to construct this, to instal a second unit, and build a sub-station, a further $151,000 will be required. The citizens will be asked to vote in favor of another by-law authorizing this expenditure.

Anderson "Reel" Specialties

The illustrations herewith represent "Reel" specialties, being marketed by the Anderson Electric Specialty Company. Fig. 1 is an "Adapt-a-Lite," furnished with small shade and universal clamp, which provides a support for the lamp and a means for hanging from the side wall, frame of bed, or projecting edge of desk or table.

Fig. 2 represents an "Auto-Reel" spot-lite. It consists of an adjustable cord reel, which forms part of the bracket and carries on its spool twelve feet of extension cord, operated like an ordinary curtain roller. Normally the cord is concealed in the ball-shaped casing. To use it as a portable trouble or inspection lamp you simply unscrew a nut, withdraw your lamp to any desired distance, and you can have light all over. One of the advantages of this lamp is that it is not detachable from your car, and so is always available.

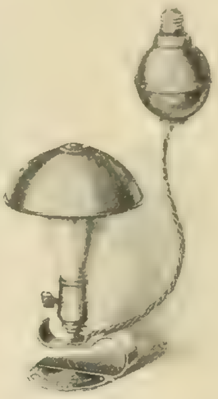


Fig. 1

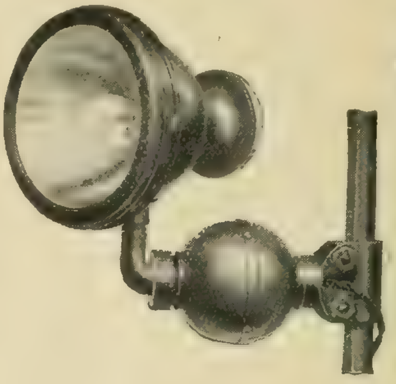


Fig. 2

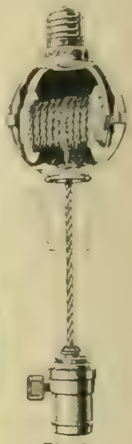
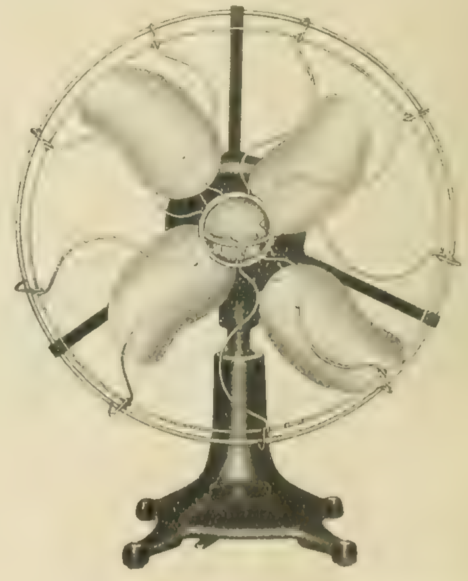


Fig. 3

Fig. 3 is an extension "drop-lite," operated on the same principle.

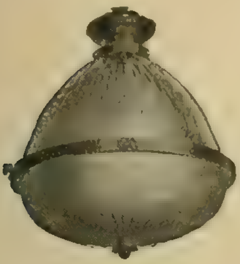
Eck Fans

The fan shown in the accompanying illustration is manufactured by the Eck Dynamo and Motor Company. This fan is worthy of special attention on account of the shape of the blades, which the company have named "[illegible]ming" blades, as indicating that they have taken the "hum" out of humming, so far as the electric fan is concerned.



The Holophane Realite.

The Holophane Realite unit has been modernized and adapted by the Canadian General Electric Company for the type "C" or gas-filled Mazda lamp, and is to-day one of the best all-enclosing glass lighting units for this type of lamp. Ventilation required is secured through slots or holes in both the top holder fitter as well as the bottom nob. The reflector half has the new velvet finish to soften the light, while the bowl part still retains the diffusing satin finish. The unit shown in Fig. 1 is made in three sizes, namely, 10 in., 12 in., and 14 in. diameter, and may be used with gas-filled lamps from 100 to 500 watt size. These units give a very broad distribution, covering wide areas, as will be noted by the average distribution curve shown in Fig. 2, representing a 100 watt lamp operating at 0.98 watts per candle. For the best results they should be spaced apart approximately 1.4 of the mounting height above the plane to be illuminated.



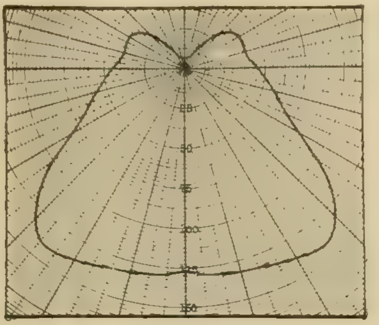
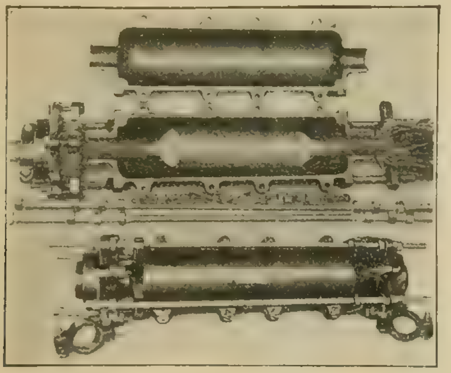


Fig. 1.—Made in three sizes.—Fig. 2, at right, shows distribution.

Improved Type of Joint-Box

In placing electric cables in underground conduits or in laying them on the bottom of a body of water frequent joints are necessary. These are apt to be weak spots, both electrically and mechanically, unless properly made and protected. A new and improved type of joint-box or housing for use on submarine cables has recently been developed and perfected by the Standard Underground Cable Company of Canada, and successfully used on submarine cables supplied the Halifax Electric Tramway Company and the city of Ottawa Waterworks Department. It has also been used in the United States on submarine cables of the Atlantic City Electric Company, on the United States Ship Canal at Atlantic City, N.J., and the Wilmington and Philadelphia Traction Company, and Pennsgrove Light, Heat, and Power Company in crossing the Delaware River at Wilmington, Del. This joint-box is so designed that all mechanical stresses resulting from the action of tides, currents, etc., that usually tend to damage the cable at these points are taken off the joint proper by long "take-up" rods on the joint-box parallel to the joint, and to which armor the rods are rigidly connected by heavy iron clamps. This construction will be made clear by reference to the illustration. As submarine cables, even under normal conditions, are subjected to severe mechanical stresses and have heretofore often failed first at the joints, this new device, which so far has proven very effective, offers a solution for a serious problem in submarine cable laying.



Submarine joint-box or housing.

The Work of the Advisory Council

(Concluded from page 28)

actual manufacture of this fuel on a commercial scale, and by actually placing it on the market for a period sufficiently long to test its suitability for the requirements of the country. In this way the first large special project on which the Council will probably embark is one connected with the mining industry of the Dominion.

(5) The Council having in view the very serious depletion which is taking place in the forests of eastern Canada, has, after a careful survey, and on the recommendation of the Foresters of the Dominion, advised the Government to make at once a very considerable grant for the purpose of beginning an investigation to be carried out under the Forestry Branch of the Department of the Interior into the best methods which can be adopted from among the various well-known plans of forest management as practised in Europe for the purpose of bringing the forests of eastern Canada under a regular system of cultivation similar to that under which the European forests now yield to the respective governments or to their owners a large and regular annual return.

Other Activities

Among the various subjects to which the Council will address itself in the immediate future may be mentioned the best method of tabulating the natural resources of the Dominion so that all the information which exists concerning them in various government departments and elsewhere may be made readily available. This is a task which it is one of the functions of the Government to carry out, and which can only be accomplished satisfactorily by Government agencies.

Another very important subject which the Council had under consideration is the best method of gathering about it and associating with its work committees of gentlemen who have made special studies or who have expert knowledge in certain special industries in any certain definite subjects, and who will be willing to help forward the development of Canada by affording their advice and assistinces in their special lines. The Council also has had submitted to it some 44 separate projects. These are already under consideration, or will receive consideration at an early date. Still other proposals have been submitted, which, while embodying a cheerful optimism and not altogether devoid of humor, will not require such an extended study.

In conclusion, gentlemen, I would remind you that the encouragement of research and the application of science to all our industries and undertakings is a great national work which must be carried forward along many lines and in many ways. The members of the Council will use their best and most strenuous efforts to secure results commensurate with the importance of the work, and they ask you one and all to aid and assist in every way in your power this great work with which the future of our Dominion is so largely bound up.

At a meeting of the Canadian Society of Civil Engineers, Montreal, on March 22, Mr. R. A. Ross presented the Gzowski medals awarded to Messrs. Julian C. Smith, E. M. Wilson, and Henry Holgate for their papers on the Cedars Rapids Development.

Current News and Notes

Bedford, Que.

High water recently carried away the dam on the river at Bedford, Que. The loss is considered serious as it was the source of supply for the Bedford Light Company, the Bedford Stove Company, and the Corey Needle Company. These concerns have auxiliary plants, but their supply of coal is limited and will have to shut down unless coal is rushed in. The town will also be without light, other than coal oil.

Brockville, Ont.

Out of the expenditure of nearly $7,000,000 proposed by the Hydro-electric Power Commission of Ontario for the year 1917, the sum of $52,880 is set aside for St. Lawrence River extensions. It is probable that this amount represents the acquiring of the power needed to furnish the amount promised to Brockville, Ont., by the Commission.

Fort Erie, Ont.

The town council of Fort Erie, Ont., contemplate the installation of an electric lighting plant. It is stated the work will start about June.

Hamilton, Ont.

At the annual meeting of the Canadian Westinghouse Company recently held at Hamilton, Ont., the following directors were elected: H. H. Westinghouse, Lieut.-Col. Paul J. Myler, L. A. Osborne, Thomas Ahearn, Sir John M. Gibson, John F. Miller, C. F. Sise, Warren Y. Soper, Charles A. Terry and G. E. Tripp. Mr. Westinghouse continues as chairman of the board, and Col. Myler as president and treasurer. While no figures are available, it is stated that the annual report is very satisfactory to the shareholders.

Montreal, Que.

The Montreal Light, Heat, and Power Company announce a rate of 1½c per kilowatt hour for electric cooking stoves in Outremont, with a minumum rate of $2 per month for every month in the year.

New Toronto, Ont.

The factories at New Toronto are complaining of the action of the Ontario Hydro-electric Commission which forces them to cease operation between twelve and one daily in order that work may be done on the wires. This, in itself, is not so serious, but the power is seldom returned at one o'clock and much time is wasted before the plants get in operation.

Saskatoon, Sask.

The city council of Saskatoon, Sask., have authorized the expenditure of $19,640 on street railway equipment.

The city council of Saskatoon, Sask., have authorized the expenditure of $31,800 for an ash handling plant and water softening equipment for the local power house.

St. Catharines, Ont.

The Hydro-electric Commission of St. Catharines have decided that in order to give St. Catharines customers the best possible service a new line must be built to the city from Niagara Falls. It is stated that work on this line will be commenced almost immediately.

St. Jerome, Que.

The town council of St. Jerome, Que., are negotiating [illegible] with steam generator

Toronto, Ont.

The Board of Education, Toronto, Ont., recently received tenders for telephone systems for some of the city schools.

The Hydro-electric Power Commission of Ontario has just purchased, through the C. E. A. Carr Co., six second-hand electric locomotives to be used on the Chippewa power development work.

The following orders have recently been received by the Turbine Equipment Company: From the Imperial Oil Company, Toronto, an order for two additional single stage, double suction, high lift De Laval pumps, each to be direct connected to 150 h.p. motors; the Union Carbide Company, Niagara Falls, N.Y., and Welland, Ont., an order for three De Laval single stage, double suction pumps of three million, two million, and one million gallons daily capacity respectively, to be motor driven; the Canadian Copper Company, Copper Cliff, Ont., an order for two single stage, double suction De Laval pumps, each having a capacity of three million gallons daily.

The suplementary estimates tabled in the Ontario Legislature include a proposed expenditure of $6,928,790 for hydro-electric development. Of this, $1,000,000 is for work on the Niagara power development, $2,360,000 on Niagara transformer stations, $985,000 on Niagara system steel tower lines and $1,695,000 for Niagara system extensions.

Winnipeg, Man.

The Winnipeg Telegram, in a recent issue, states that the Winnipeg Electric Railway has served notice on the city of a claim for damages amounting to one million dollars for loss sustained by the company due to competition from jitneys.

An Electric Outboard Motor, Jewel Electric Co.
See Description on page 33.

Electrical News
Generation, Transmission and Application of Electricity

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Vol. 26 Toronto, May 1, 1917 No. 9

Electric Club of Toronto Doing War Production Work

The Electric Club of Toronto is endeavoring to do its fair share towards increasing the production of food stuffs, for after the luncheon on Friday, April 20, the secretary outlined a scheme for cultivating a number of acres of vacant land in the northwestern section of the city. The section under discussion is approximately five acres, on which it is planned to grow potatoes, the work to be done entirely by the members of the club. The plan is to make the returns from the harvest pay all actual expenditures; the surplus, if any, will be donated to some patriotic enterprise, such as, for example, the Red Cross. The interim financing is being taken care of by various members of the club.

The secretary has calculated that a maximum of 400 days' work will be required throughout the season and a schedule is being arranged as completely as conditions will permit. Already a number of members have signified their intention of taking one week of their holidays in this way and a still longer list to be known as the "emergency corps" have agreed to hold themselves in readiness for a day's work at short notice.

The action of the members of the Electric Club is greatly to be commended, for the benefits are manifold. First and chief, perhaps, is the example they will be placing before less energetic and patriotic members of society. Next, there is the actual increase in production to be considered. There is also a good fighting chance of a fair profit if the season is favorable, and last, there is the benefit to the individual members of the club social, mental and physical. If any member has not yet volunteered for this "greater production service," he is requested to get in touch with Mr. Groome without delay.

Two Miles Falls Development

Walter J. Francis & Company, consulting engineers, Montreal, recently made a report to the city of Sherbrooke on the cost of purchasing the rights of a company operating at Two Miles Falls, Weedon, Que., the further development of this plant, and the construction of a second hydro-electric power house approximately a mile lower down on the St. Francis River. The total cost was placed by the engineers at $1,453,000, and a by-law has just been passed by the city of Sherbrooke covering the purchase price of the present plant, $375,000. The situation with regard to this development scheme as outlined in the report of the engineers is, briefly, as follows:

At Weedon, on the St. Francis River, there is already in operation under a 30 ft. head a unit rated at 1,250 h.p., the turbine for which was installed by the William Hamilton Company, and the generator by the Canadian General Electric Company. This unit was installed in 1915. It is proposed to add to this plant another unit capable of developing 2,500 h.p. The report also indicates the possibility of a second dam and power house about one mile down stream from the existing plant, where a head of approximately 50 feet will be obtainable. In this second power house it is proposed to install three 60 cycle, 3 phase, 2,400 volt generators mounted vertically over single runner 2,700 h.p. turbines.

It is proposed to step the voltage up from 2,400 volts to 60,000 volts and transmit by two separate copper circuits direct to Sherbrooke, a distance of about 28 miles.

It is thus estimated that the completed installation will deliver power in Sherbrooke at a capital expenditure of approximately $150 a h.p. Counting interest, sinking fund, depreciation and operating costs, it is considered that power can be delivered in Sherbrooke at 2,300 volts for about $17 per horsepower.

A second by-law is being submitted to the electors this month covering the cost of the second generator unit at the present plant, and also a transmission line to Sherbrooke. There is no intention at the present time to develop power at the lower site.

Regulations Regarding Norwegian Waterfalls

The Norwegian Government has recently been advised by a committee of the Storting not to allow foreigners or foreign corporations to acquire waterfalls in Norway, except in special circumstances.

The power contained in the waterfalls of Norway and which may be profitably utilized are not known, but has been estimated at from 6,000,000 to 10,000,000 horsepower. Up to the present the development of these falls has been accomplished largely through the aid of foreign capital, and the rapid progress made was further helped by the complete freedom of private enterprises in this field; from 1887 to 1909 the right of private ownership of the falls was fully recognized. The investment of foreign capital was made necessary because of the lack of sufficient financial resources within the country itself. At the same time it was felt that the natural resources of the country should belong to the State and that the nation as a whole should profit by their utilization.

A solution of the problem was reached in the so-called concession act of September 18, 1909, which greatly restricted the permission of foreigners to acquire and use such property. By the terms of this statute only the Norwegian State, Norwegian municipal corporations, and Norwegian subjects were permitted to acquire waterfalls of more than 1,000 horsepower, without government sanction for each individual case. This law was made more stringent by the Act of August 3, 1911, which was designed to secure rational utilization as to raising the water level in lakes, construction of draws, etc., and provided for a tax payable to the commune and to the State.

A royal commission has been at work for several years on a revision of concession legislation, and has just submitted to the Storting a new bill. Under this new bill it will be more difficult than ever for foreigners to invest capital in Norwegian industrial enterprises and other real property. It is also proposed that foreign subjects and companies shall not be allowed to acquire concessions except in special cases, as, for instance, when an industrial concern already in operation wishes to acquire or regulate a waterfall. Joint stock and other limited liability companies must henceforth have an exclusive Norwegian board with registered office in Norway, also exclusively Norwegian capital, in order to obtain permission to acquire waterfalls. It is also intended to fix the period for such concessions to sixty years as a maximum, and the State shall have the right to redeem the waterfall at the latest in the fortieth year after the granting of the concession. In the case of mining property a concession period of not more than fifty years is proposed. The concessionaire must engage not only to build workmen's dwellings, but also schools and assembly rooms, and also to make an annual payment in the form of a risk premium to cover injury sustained by workmen, besides the usual and greatly increased dues to the State and the local community.

Foreign Capital in Industrial Enterprises

This bill marks a reaction against the great industrial development of Norway, which has been founded to such a large extent on foreign capital. An investigation of these conditions made in 1909 showed that of the $80,400,000 then invested in industrial companies, $30,820,000, or 38 per cent., were in foreign hands; out of $10,720,000 of share capital in electro-chemical enterprises as much as 85 per cent., and of the $5,360,000 in mining 80 per cent. was foreign.

Advisor to French Government

Dr. Louis Herdt, of McGill University, is acting as honorary advisor to the French Government in the selection and purchase of electrical supplies. Very large orders, amounting to over $2,000,000, have been placed with Canadian firms, principally wire and cable companies, which otherwise might have gone elsewhere. At the invitation of Dr. Herdt representatives of the French Government visited many of our factories, and the business referred to above followed.

Hydro in Smith's Falls

The Hydro-electric Power Commission of Ontario recently discussed at an open meeting in Smith's Falls the question of developing one or two comparatively small water powers on the Mississippi River to supply power to Smith's Falls and neighboring towns. The water powers which it is proposed to develop are now owned by Mr. G. A. Burgess and the two waterfalls around which the discussion centers are High Falls and Rosebank. High Falls is said to have a capacity of approximately 2,000 h.p., and to be capable of a very economical development.

Mr. Burgess has offered to develop this power and transmit a supply to Smith's Falls. The Hydro Commission however, will be asked to make a report on the cost of development, transmission and distribution as a municipal enterprise. The problem in Smith's Falls includes the purchase of two private companies already operating in that town. It is understood, however, that these two companies are ready to dispose of their property for a fair figure.

Electric Drive for U. S. Battleships

Contracts totaling approximately $2,000,000, have been placed recently with the Westinghouse Electric & Manufacturing Company of East Pittsburgh, Pa., by the New York Shipbuilding Company, for furnishing the necessary electrical equipments for the propulsion of the new superdreadnaughts Colorado and Washington. The equipments to be furnished are practically duplicates of that contracted for by the Navy Department for the U.S.S. Tennessee, now building at the New York Navy Yard. The four propellers, as in the case of the Tennessee, instead of being mechanically connected to driving engines or turbines, are to be driven by individual motors. The current for the motors will be furnished by two turbine generators. In addition to the main generating equipments and propelling motors, the contracts include auxiliaries for the main turbine generators, and smaller auxiliary turbine generators for supplying light and power throughout the ships. Westinghouse electric motors will also be utilized for doing nearly all the work on board.

Engineers' Club, Peterboro

A meeting of the Engineers' Club of Peterboro, Ont., was recently held in the Oriental Hotel in that city. The business of perfecting the organization was taken up, the meeting being opened with a discussion on the proposed constitution of the club, which, after some suggestions, was referred to the executive for further consideration. It was decided that the regular meetings would be held on the second Thursday of each month, September to May, inclusive, and that the present officers would hold their positions till May, 1918. The following three committees were appointed: Membership, meetings and papers, and entertainment. The paper of the evening was read by Mr. A. G. Grier, of the Canadian General Electric Company, his subject being "The Status of the Engineer." The club has a membership of 35, and those instrumental in its initiation have reason to be gratified by the interest taken in it. The officers are as follows: Honorary president, R. B. Rogers; president, C. E. Canfield; vice-president, P. P. Westbye; secretary-treasurer, R. L. Dobbin; directors, G. R. Munroe, C. E. Sisson, Wm. Sangster, H. O. Fisk, R. H. Parsons.

Automotive Electric Association

An organization of manufacturers of Automotive Electric Accessories was formed at Atlantic City, New Jersey, Monday, April 16th, 1917. This new organization will be known as the Automotive Electric Association. Among its members are the largest and best known manufacturers in this line. The purposes of the organization are to improve and develop this branch of Automotive Electric Accessories' business through standardization and by friendly interchange of experience with reference to design and manufacture.

Pro Patria

Captain Harry F. Sare, of the Bell Telephone Company, Montreal, has been killed in action while leading his men on April 9th at the battle of Arras. Recently he received promotion to captain and was given command of a divisional training school in France, but at his own request was sent back into the firing line. He was one of only three officers left of the original unit

The Water Powers of Western Canada

Comprehensive Data on the Hydraulic Resources of Manitoba, Saskatchewan and Alberta Compiled by the Commission of Conservation—The Nelson River with its Minimum of a Quarter Million Horsepower

The Nelson River flows through the central portion of northern Manitoba. Rising in the northerly end of Lake Winnipeg, it flows in a general north-easterly direction, discharging into the southwest corner of Hudson Bay.

The Nelson River, as the outlet of Lake Winnipeg, discharges the waters collected from an immense drainage area. It is one of the main drainage systems of the northern continent, having a tributary area of approximately 450,000 square miles. This vast area extends from the height-of-land, a short distance west of Lake Superior, to the Rocky Mountains. To the north, the basin is bounded by the Athabaska and Churchill watersheds, while the southern drainage extends down into the Northern States. Rivers tributary to Lake Winnipeg, and having immense areas of tributary drainage themselves, comprise such systems as those of the Winnipeg, Red, Dauphin and Saskatchewan rivers. Numerous smaller rivers, including the Berens, Pigeon, Manigotagan and Brokenhead, also contribute to the flow from Lake Winnipeg.

From the tremendous expanse of Lake Winnipeg and its tributary systems of great lakes, comprising Lakes Manitoba and Winnipegosis, a natural regulation of the flow of the Nelson River results, and the range between flood and minimum discharge is not high. In this respect, it is similar to the St. Lawrence, which is regulated by the Great Lakes.

General Description of River

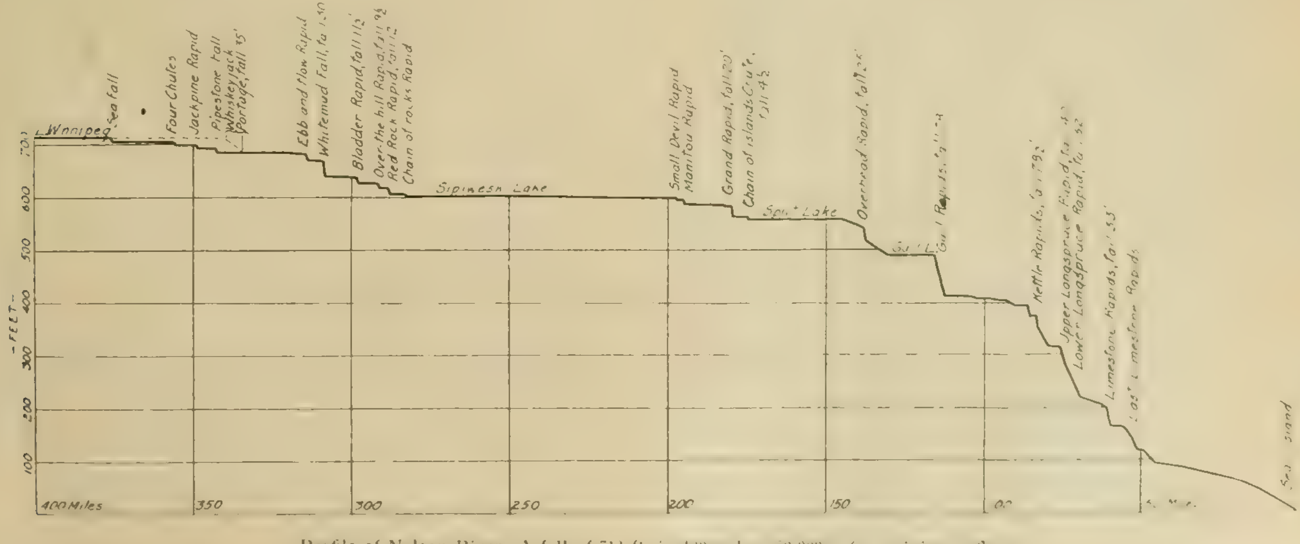
The length of the river from Lake Winnipeg to Hudson Bay is 430 miles. In this distance a descent of 713 feet occurs. The upper reaches of the river are more properly described as a chain of lakes connected by falls or by reaches of river and rapids. In this upper portion of the river, extending approximately to Split Lake, some 250 miles from Lake Winnipeg, the banks are in general higher than in the lower portion. Although the river, as stated, expands in this upper section into many lakes of slow-running water, yet the falls are more sharply defined and are usually of steeper descent than those in the lower reaches, and also are often separated by islands into numerous narrow channels. Not only are the banks lower as Lake Winnipeg is approached, but the distance between them increases. The descent in the lower portion is less abrupt, being more often a series of rapids or swift-running water. These latter characteristics gradually become more accentuated as Hudson Bay is approached.

Discharge Measurements

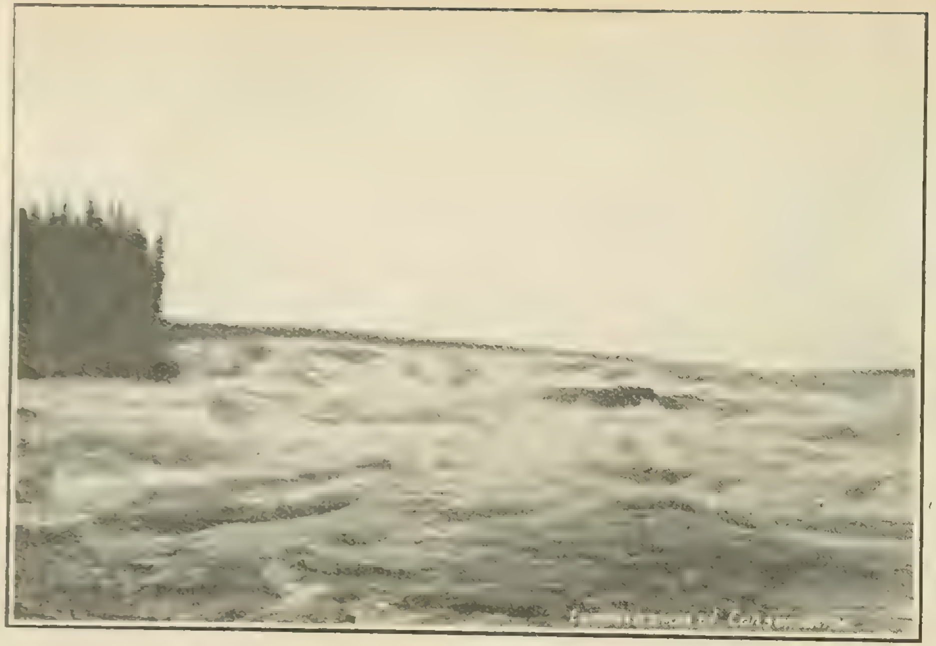
Several discharge measurements have been made on the Nelson River, though none of them, apparently, determine its low-water flow. Discharge measurements made by Mr. William Ogilvie in the latter part of August, 1910, in the vicinity of Whitemud Fall, indicate a discharge of 109,364 second-feet. Mr. Miles, of the Department of Public Works, obtained a discharge measurement at the outlet of Sipiwesk Lake on October 6, 1909, at what was stated to be a very low stage of the river; this recorded a flow of 118,369 second-feet. In September, 1913, measurements of the flow of the East and West rivers were made by Alexander Pirie, of the Manitoba Hydrometric Survey. On September 16, 1913, the total flow on the East River, below Sea River Fall, was 19,762 second-feet. On September 25, 1913, the flow on the West River, in the vicinity of Whisky Jack portage, was 46,549 second-feet. At the time of metering the West River, a storm from the northwest lowered the level of Lake Winnipeg at its outlet, which undoubtedly greatly decreased the flow. A regular metering station was established by the Manitoba Hydrometric Survey at the Manitou Rapid on July 18, 1914, and continuous readings secured till September 24 of the same year; the discharge during this period ranged from 87,000 to 103,000 second-feet. Records were also secured at this station during the winter of 1914-15, a low flow of approximately 45,000 second-feet being recorded.

As stated previously, any extreme variation in the flow of the Nelson River is hardly possible, due to the immense expanse of Lake Winnipeg, which offers unexcelled facilities for storage regulating the flow. The lake comprises an area of 9,414 square miles, and, in extent, ranks fifth in superficial area of the lakes of North America; it is over 2,000 square miles larger than Lake Ontario and slightly smaller than Lake Erie.

In considering the character of its rapids and falls, the

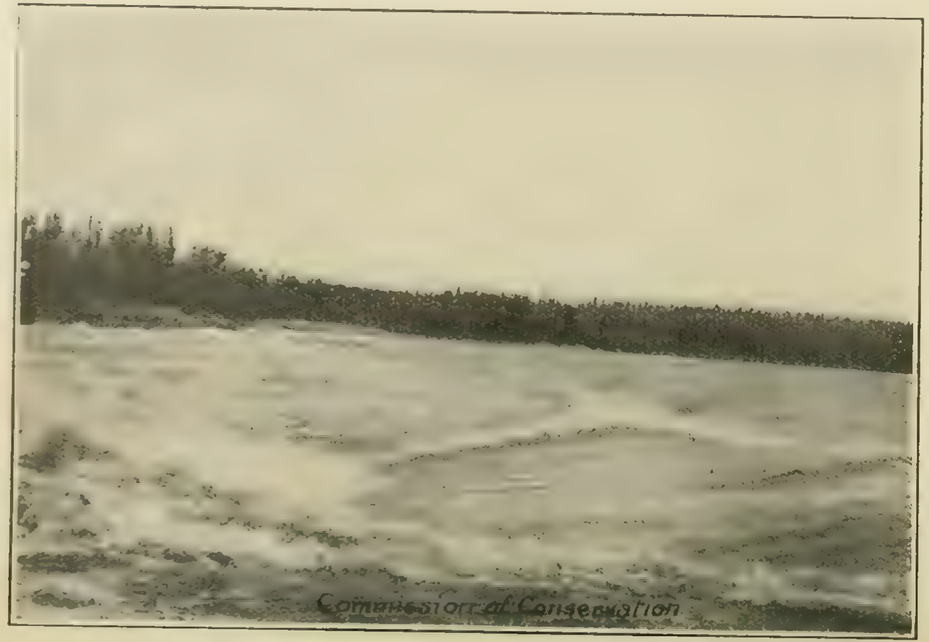


Profile of Nelson River. A fall of 713 ft. in 430 miles. 50,000 c. f. s. minimum flow.



Nelson River—Grand Rapid (at Head)

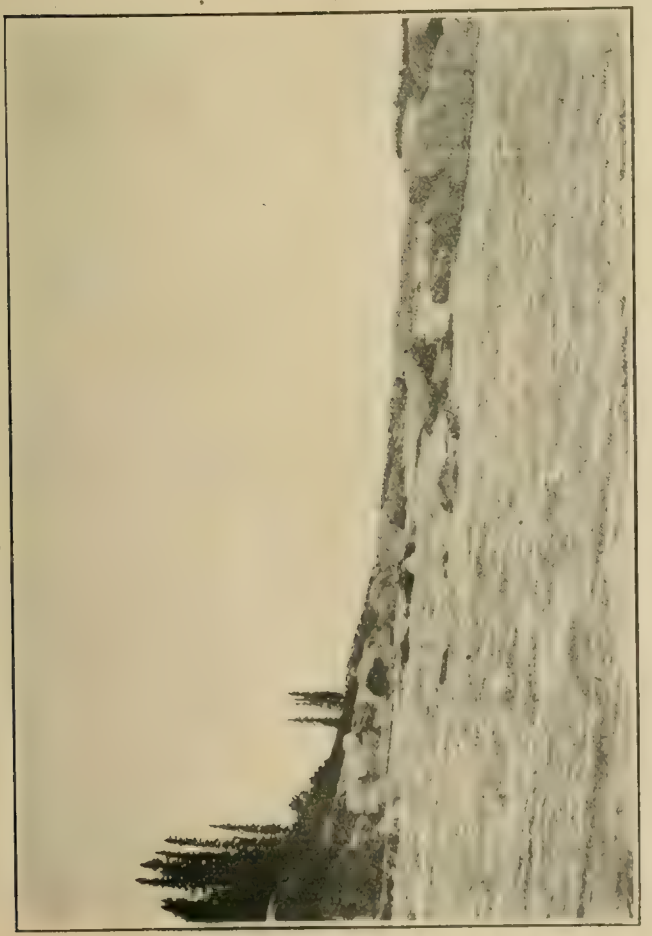
Nelson River—Whitemud Fall (West Channel)



Nelson River—Bladder Rapid

Nelson River—Sea Fall (East Channel)

Nelson River—Ebb-and-Flow Rapid



Nelson River—Kettle Rapid

Nelson may be divided into three sections, (1) from the mouth to Kettle Rapids, (2) from Kettle Rapids to Split Lake; (3) above Split Lake.

In the lower portion, namely, below Kettle Rapids, it is generally very wide and free from islands where rapids occur. The rapids have a very gradual descent, are quite long, and, on account of the great width of the river, the prospects for power development are not very attractive.

In the portion between Split Lake and the foot of Kettle Rapid, there are many islands where the rapids occur. The rapids are steeper and, although, in some cases, the banks are rather low, this portion offers greater possibilities than the lower.

In the two sections just described, which include all the river below Split Lake, there is a practically continuous series of rapids and swifts. Even between rapids there are no still-waters; these stretches are either swift or rough.

Above Split Lake, the rapids and falls are well-defined, and their descents are generally steep as compared with those in the lower portion of the river. In this section, except above Pipestone Lake, the stretches between the chutes or rapids have very sluggish currents; the total descent in the river really occurs only at the chutes and rapids which, especially above Sipiwesk Lake, occur in numerous narrow channels separated by islands. Where these islands are situated, the river is quite wide, but the individual channels between islands are narrow. Power development in this part of the river should be accomplished easily; respecting the higher falls, i.e., those over eight or ten feet in height, there is no doubt that the total head can be utilized, while the chutes and rapids with less descent might be combined or used to increase the natural heads of the higher falls.

Herewith is a table giving the principal estimated water powers calculated on a flow of 50,000 c.f.s.:—

Nelson River Estimated Water-Powers

Power site	Head (in feet)	Available theoretical horsepower (May to Nov.)	Remarks
1st Last Limestone rapid	6	34,700	¼ m. long
2nd Last Limestone rapid	15	87,000	1 m. long.
3rd Last Limestone rapid	10	57,900	½ m. long
4th Last Limestone rapid	10	57,900	1 ½ m. long
Lower Limestone rapid..	8	46,300	⅝ m. long
Upper Limestone Rapid..	25	144,700	¾ m. long.
Lower Long-spruce rapid	52	301,000	4 m. long
Upper Long-spruce rapid	40	231,500	2 m. long.
1st Kettle rapid	40	231,500	3 m. long
2nd Kettle rapid	21½	124,500	½ m. long, H.B. Ry. crossing
3rd Kettle rapid	17	98,500	100 yards long.
1st Gull rapid .	20	115,800	1 ⅓ m. long. Head could be raised to 30 feet
2nd Gull rapid .	20	115,800	500 yards long.
3rd Gull rapid ..	21	121,500	250 yards long
4th Gull rapid	17	98,500	⅜ m. long
Overfall rapid . .	25	144,700	½ m. long
Chain of islands chute ..	4½	25,500	300 yards long. Possible head 8 feet.
Grand rapid . . .	20	113,500	160 yards across portage. Possible head 26 feet
Manitou rapid .	25	142,000	Head created by dam.
Red Rock rapid	12	68,000	900 yards long.
Over the hill rapid .	9½	54,000	Possible head 13 feet
Bladder rapid	11½	65,500	900 yards long.
Whitemud fall ..	30	170,000	500 yards across portage
Ebb and flow rapid	9½	54,000	
Whiskey Jack portage	35	200,000	

The Bell Telephone Company put into operation on April 18th a central energy system at Barrie, Ont. Owing to the large increase in the business a new exchange has been constructed.

Lieut. J. Lloyd Stevenson, of the treasurer's office, Bell Telephone Company, Montreal, was killed during the recent fighting in France. He was an officer in the 14th Canadian Battalion, and was 23 years of age.

The Evolution of the Electrical Process of Manufacturing Steel

By Mr. Geo. M. Berry*

This title has been chosen because it is fitting that this first chapter which has been fully as brilliant in achievement as any which has ever adorned metallurgical history should have more than passing notice, and because the utilization of the electric furnace in the manufacture of steel has, during the past year, become so unprecedented in extent. I am doubly happy in the pleasure of addressing you this evening because it was my privilege almost a year ago, before the Syracuse Section of the American Chemical Society, to present the Decennial of Electric Steel in America at a time which was by striking coincidence within two days of being just ten years after the first heat of electric steel in a commercial plant in America was tapped and cast into ingots. The date of this heat was April 5, 1906.

After all, the present subject may have been better stated as "The Electric Furnace in Steel Making; its present development and prospect," for its development is so interwoven with progress in this line in Europe that no comprehensive understanding of electric steel in America can be had without consideration from a point of view which overlooks national boundaries. This subject, unlike the great majority of those which engage our thought and activities has had its conception, birth, and present development entirely within the life of even those of us who are still very young men.

Siemens' Prophetic Vision

The first record we have of the utilization of electricity in the melting furnace for steel was by Sir William Siemens in 1880 (Journal of the Society of Telegraph Engineers, Vol. 9, 1880, pages 278-303). In his paper before the British Society of Telegraphic Engineers, he states:—

1. "The Scientific Papers of Sir William Siemens," Volume 2, (published 1889) page 220, is found the paper of 1880 before the Society of Telegraphic Engineers.

"My present object is to show that the electric arc is not only capable of producing a very high temperature within a focus or extremely contracted space, but also such larger effects, with comparatively moderate expenditure of energy, as will render it useful in the arts for fusing platinum, iridium, steel, or iron, or for effecting such reactions or decompositions as require for their accomplishment an intense degree of heat, coupled with freedom from such disturbing influences as are inseparable from furnace worked by the combustion of carbonaceous material."

He further states:—1. "To melt a gram of steel in the electric furnace takes, therefore, 450 x 18 = 8,100 units, which is within a fraction the heat actually contained in a gram of pure carbon. It results from this calculation that, through the use of the dynamo-electric machine, worked by a steam engine, when considered theoretically, one pound of coal is capable of melting nearly one pound of mild steel. To melt a ton of steel in crucibles in the ordinary air furnace used at Sheffield, from 2½ to 3 tons of best Durham coke are consumed. The same effect is produced with one ton of coal when the crucibles are heated in the regenerative gas furnace, whilst to produce mild steel in large masses on the open hearth of this furnace, 12 cwt. of coal suffices to produce one ton of steel. The electric furnace may be therefore considered as being more economical than the ordinary air furnace, and would, barring some industrial losses not included in the calculation, be as regards economy of fuel nearly equal to the regenerative gas furnace.

"It has, however, the following advantages in its favor:—

1st. That the degree of temperature attainable is theoretically unlimited.

2nd. That fusion is effected in a perfectly neutral atmosphere.

3rd. That the operation can be carried on in a laboratory without much preparation, and under the eye of the operator.

4th. That the limit of heat practically attainable with the use of ordinary refractory materials is very high, because in the electric furnace the fusing material is at a higher temperature than the crucible, whereas in ordinary fusion the temperature of the crucible exceeds that of the material fused within it.

This work by Siemens was followed by the furnace of Cowles in 1885, aluminum; Heroult and Hall, 1886, aluminum; Colby in 1887, induction steel furnace; Willson in 1893, calcium carbide at Spray, N.C.; Acheson in 1896, carborundum; Stassano in 1898, reduction of iron ores. Then following these came the several types of steel furnaces which mark the beginning of commercial electric steel.

During all of these few years there has been a great deal of pioneer work—a vast amount of it—and much has been accomplished.

Progress Has Been Rapid

Men's minds have been exceedingly fertile with suggestions and accomplishment. Many patents have been granted. In the sense that the building and operating of the initial furnaces, and in some cases subsequent furnaces, as well, for the various types, was in each case an experiment requiring not only capital but faith and dogged perseverance as well, much experimentation has been done. It is, perhaps, also a fair observation to say that comparatively little thoroughly scientific or exhaustive technical research into many of the very important problems (such as slag reactions, melting losses, refractories, electrodes, comparative values of the various types of furnaces) has been made; at least comparatively little by those who do not have some type or other to sell has appeared in the literature. This condition of the research of the subject makes even more pointed the truly wonderful development which has been wrought in this application of this even comparatively new form of energy in this old, useful, and wonderfully fascinating art. Here we truly live in divine times when "a day is as a thousand years."

The actual beginning of the new era in the production of fine steels in America took tangible form when negotiations were begun by the Halcomb Steel Company in the early part of the year 1905, which led to the making of a contract with the Societe Electro-Metallurgique Francaise and culminated in the installation of a furnace for using the Heroult process by the Halcomb Steel Company at Syracuse, N.Y.

The advent of the electric furnace as furnishing a possible process of manufacture of iron and steel is very closely contemporaneous with the beginning of the 20th century. The utilization of electricity in the production of iron and steel in America may be said to have begun its crystallization in December (29th), 1903, when, under instruction from the Minister of the Interior of Canada, Dr. Eugene Haanel, was commissioned to "proceed to Europe for the purpose of investigating and reporting upon the different electrothermic processes employed in the smelting of iron ores and the making of the different classes of steel, then in operation, or in process of development."

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*[illegible] Halcomb Steel Co., Syracuse, N.Y.

This report, which was submitted August 1, 1904, states fairly well the development up to that date and deals principally with the Keller, Kjellin, Stassano, and Heroult furnaces which were in principle respectively resistance, induction (without electrodes) arc. and arc-resistance.

The practically simultaneous appearance of these different types of furnaces is shown by the fact that many patents were obtained in rapid succession for each of these processes almost simultaneously in practically all the industrial countries of Europe, in Canada, and in the United States. The initial patent and the country where first obtained was as follows:—

1. Stassano, Italy, March 17, 1898.
2. Keller, Germany, December 16, 1899.
3. Heroult, France, March 27, 1900.
4. Kjellin, Finland, August 1, 1900.

From the metallurgical point of view, the electric furnaces of to-day are of two classes; first, those, such as the Kjellin or Colby, which, like the crucible process, are solely melting furnaces. That is, there is no elimination of metals or metaloids in chemical combination, and if, therefore, the best grade of finished steel is desired, only the purest materials may be used to start with. Second, those which are smelting and refining furnaces, such as the Keller, Girod, Rennerfelt, Roechling—Rodenhauser, and Heroult. Furnaces of the second classification may be used for (1) the direct reduction of iron from its ores; (2) the refining of pig iron direct from the blast furnace; (3) for the melting and refining of either pig iron or scrap starting with a cold charge; (4) the electrical refining of metal taken moulten from either the Bessemer or open hearth where a preliminary refining has been carried out.

Let us now get a little closer view of these different types of furnaces.

Induction Type

In taking this type of furnace first, I do so because the application of electrical energy for the production of steel was first invented and patented in America as utilizing this energy in this form. The inventor, Edward A. Colby, was an American. This furnace later loses its identity in name because of a combination of the interests of a number of induction furnace patentees.

The development of induction furnaces may be considered as (1) from stationary to tilting in physical design; (2) from simple induction to combination of induction with conducting plates, and (3) from single phase to three-phase current.

The induction furnaces of to-day are of two distinct types; one, the simple induction furnaces of the type of Colby and Kjellin, and second, the "Combination Furnace," invented by Messrs. Roechling and Rodenhauser, Germans. This later type is a combination of the simple induction principle with the utilization of plates for conducting current to the bath. These amount to electrodes, although the inventors rather dislike the use of that term for they are hardly electrodes in the ordinary furnace-practice sense. As has been said, those of the first type are melting furnaces only, while those of the "Combination" type are for melting and refining.

The Colby Furnace

The early Colby furnace dates back to 1887. The first commercial installation of this furnace, which was also the first installation of an induction furnace in America, was at the plant of Messrs. Henry Disston & Sons. It is worthy of note that all the induction furnaces of the Colby design were made of tilting design, and that the early European furnaces of this type were not.

This furnace is described as follows:—"It is rated at 130 kilovolt amperes. The voltage of the single phase primary current is 240 volts, the maximum current 540 amperes, and the frequency 60. The primary consists of 28 turns of copper tube 3/8 in. inside diameter by 5/8 in. outside diameter, and is cooled by internal water circulation. The annular crucible, which with its contents forms the secondary of the transformer, is a one-piece crucible 14 7/8 in. inside and 24 1/4 in. outside diameter, 8 in. in height. The trough is 6 3/8 in. deep by 2 7/16 in. wide at the top and 2 in. wide at the bottom, with a working capacity of 190 lbs. of steel. The current in this crucible is at a maximum 15,148 amperes at 8.57 volts."

Ingots of 90 lbs. were poured every hour, leaving 100 lbs. in the furnace. When additional material is added, the fusion is complete in about half an hour, leaving the other half hour for killing. This furnace requires about 40 kw. maximum, the current regulation being practically controlled by the amount of metal in the crucible. The current used per 100 pounds of metal present varied from 27.5 to 37.5 kw. hours, according to the nature of the charge.

The Kjellin Type

The Swede, Dr. F. A. Kjellin, is conceded to have worked out independently a furnace involving the induction principle, almost identically as supplied and patented by Colby some twelve years before. Kjellin utilized as base material for his charge White Dannemore pig from Gysinge ore and Walloon bar ends.

This is an annular hearth with magnesite through the centre of which passes one leg of a transformer. Around this leg the primary coil is placed. This primary coil is connected to the terminals of a single phase alternator or transformer and the alternating current in the primary induces a current of low voltage and high amperage in the annular hearth which is the secondary. This then is equivalent to a transformer with a single secondary turn (the annular ring).

The Canadian Commission Report of 1904 reports development of the original Kjellin up to that time as follows:

"At the Gysinge Works, steel of superior quality is made by the smelting together of charcoal-pig and scrap in electric furnaces of the induction type, i.e., furnaces without electrodes. The process does not permit the purification of the materials entering into the composition of the steel produced, the quality of the steel depending entirely upon the purity of the component materials employed. The process, therefore, corresponds to the crucible steel process."

The furnace, of 225 h.p. capacity, is of the induction type, corresponding to a step-down transformer.

Roechling and Rodenhauser

To overcome the disadvantages charging and discharging the annular ring of the furnace at Gysinge, Roechling and Rodenhauser improved the Kjellin furnace to be installed at the Roechling works at Voelklinger, making it of tilting design supported by trunnions so that when the back was raised the front, or tapping spout side, would be lowered. This improvement at once made possible the treatment of the metal with a series of slags for removal, to a limited extent, of impurities. It very early developed that the power cost for cold melting was too high. A large installation of this kind for making rails and other high class heavy material was made about 1907, in which the charge is moulten metal from the basic Bessemer. The capacity of this furnace is about 25 tons of steel, of which about 14 tons are tapped at each heat. The current used is 736 kw.

The next step in the development of this furnace was [illegible] of [illegible] two methods of electric heating. Like the [illegible] furnace, this furnace is in essentials a transformer with [illegible] single primary winding around both cores of the [illegible]. There are two secondaries. One is in the [illegible] only in the form of a figure 8, the channel between the two cores being very broad. The other secondary is a copper winding around the primary windings of both cores. These secondary copper windings are connected with metal plates inserted in the furnace well. These plates are inserted in such a way that the currents pass from them through a layer of highly refractory electrolytic conductor (of same nature as a filament for Nernst lamp) to the moulten metal in the furnace. In this way the charge in the furnace is supplied with double source of heat; the one by direct induction, and the other by the currents from the opposite sets of electrodes. The furnace is started up by putting in rings of soft steel, and holding at 900 to 950 degrees until refractories are dried; then moulten metal to bring to full heat requires about 18 hours.

The third important step in the development of this furnace was the adaptation of it to the use of three phase current (described by Prof. B. Neuman, Stohl and Eisen, Aug. 12 and 19, 1908). The advantages of this are at once apparent, because of the ability to use current from standard three phase generating systems.

In this furnace the three transformer coils are surrounded by the heating channels. The pole plates are located in the sides at the places opposite the spaces between the cores where the annular channels enter the hearth. The material charged, can be either cold or hot metal. The product from the larger furnace seems now to be used chiefly for rails, boiler plates, and high quality structural material, while from the smaller furnaces it is reported as being used for tool steel. These furnaces are operated basic exclusively. The power factor is about 80.

Frick Furnace

Otto Frick is the inventor of a furnace which utilizes the principle of types already mentioned, but separates the limbs of the cores (the rectangular iron) at a distance so that the leakage fields do not pass through this iron when the furnace is working. The Frick interests are now combined with those of Colby, Kjellin, and Roechling-Rodenhouser. The Frick modification is said to be applied to some of the furnaces at the Krupp Works at Essen.

(To be continued.)

Pensions for Bell Telephone Employees

On July 1st the Bell Telephone Company will put into operation a comprehensive plan to provide pensions, accident and sickness disability benefits, and benefits to dependents of deceased employees. This scheme will apply to the 9,000 employees of the company, who, however, will not be called upon to share any of the cost. The fund will be administered by five officials.

Employees whose age is 60 or more (females 55 or more) and whose term of employment has been 20 years or more may be retired on pension, either at their own request or at the discretion of the committee. Employees whose age is 55 to 59 years (females 50 to 54) and whose terms of employment has been 25 years or more, as well as those whose age is less than 55 years (females less than 50), and whose term of employment has been 30 years or more, may be retired on pension only at the discretion of the committee.

[illegible] employment has been 15 years or more, and who becomes totally disabled by reason of sickness, may be granted a disability pension which shall [illegible] the committee may decide. Such disability pension shall be granted only at the discretion of the committee.

The pension in the above cases is 1 per cent. of the average annual pay during the ten years next preceding retirement, multiplied by the number of years in the employee's term of employment. Employees who become 70 years of age shall retire from the employment of the company.

The following are provided as accident benefits on account of physical disability:

1. Total disability benefits equal to full pay for 13 weeks, half-pay for remainder of disability. Maximum benefits not to exceed $20 a week after six years of such payments.

2. Partial disability benefits—for first 13 weeks equal to 100 per cent. of loss in earning capacity; for remainder of disability equal to 50 per cent. of loss in earning capacity. Period of payments not to exceed six years in all.

Provision is also made as regards sickness disability benefit, death benefits, and accident death benefits. The sum payable under the death benefit clause will not exceed $2,000, and under the accidental death clause (arising out of and in the course of employment by the company) $5,000.

Hydro Expenditures 1917

The following estimates of capital expenditure for 1917 in connection with hydro-electric power development, have been tabled in the Ontario Legislature: Niagara power development, $1,000,000; Niagara System steel tower lines, $985,001.89; Niagara transformer stations, $2,364,791.31; Niagara distributing stations, and low-tension transmission lines, $344,495.64; Severn system extensions, $121,258.45; St. Lawrence system extensions, $52,880.95; Eugenia system extensions, $217,897.32; Port Arthur system extensions, $6,185.62; Muskoka system extensions, $17,298.92; Central Ontario system extensions, $1,695,000; Miscellaneous expenditures, $112,000; Office building, $12,000.

Mr. Archdeacon Back in Harness

Mr. Geo. A. Archdeacon, general manager of the Canadian Hart Accumulator Company, Limited, of St. Johns, Que., has, we regret to state, been confined to his bed for the past month with a very severe attack of typhoid fever which he contracted through the recent epidemic in St. Johns. This occurred at an inopportune time, as he was in the midst of his final arrangements for fixing up agencies and service stations from coast to coast to look after the M.S.L. batteries. Mr. Archdeacon is hoping to get back into harness very shortly, and asks that any firm which may feel that they have been neglected by not hearing from him direct, will please accept this as an explanation of the cause of any delay, either in terms or shipment of batteries. He will be pleased to hear from all interested in M.S.L. batteries, and receive suggestions from dealers as to their prospects of running a suitable service station in their town. Very special discounts are allowed to service stations, an item which should be of interest and prove very attractive to dealers in storage batteries.

Vancouver Electric Cooking Rate

Electricity for electric ranges of 2½ kilowatts and up is supplied through a separate meter at three cents net a kilowatt hour, over periods not less than twelve months. Flat rate for an electric water heater of 750 watts used in conjunction with an electric range and also over periods of not less than twelve months is $2.50 a month. This heater is connected continuously except when the range is in operation but the current is not metered.

Opportunity for Pulp Mills in Alberta

By Arthur J. Cantin

In Alberta the conditions are exceedingly favorable for the establishment of pulp mills. The home trade is quite extensive and the neighboring provinces offer a good market, as we could compete favorably with eastern and British Columbia manufacturers. The freight rates are in our favor. Then again, we have a market in the northwestern States which should prove worth while, as there are no pulp mills in Montana, Idaho, Wyoming, North Dakota, South Dakota and Nebraska. The total capacity of pulp mills is not over 150,000 tons per year west of the Mississippi River.

We first meet competition in Minnesota, then California and Texas. Surely some part of this vast area would prove to be an exceedingly profitable market. News print is quoted in Edmonton at $2.35 per 100 pounds f.o.b. Quebec or Ontario shipping point, the freight rate from Toronto, Ont., is $1.20 per 100 pound carload lot. At this price there should be a good profit in the manufacture of paper in this province as all conditions for a successful enterprise are found here.

Raw Material in Unlimited Quantity

We have the raw material in unlimited quantity. Our rivers offer sources of cheap power unequalled anywhere west of Winnipeg. The labor should offer no unusual problem as there is a large number of immigrants coming to this western country from city and industrial centres, who have no idea of farming but who are looking for work of some kind. From this class of immigrants the pulp mills should draw their supply of laborers.

Labor should be plentiful in this province, if we look at the population increase since 1901. At that date what is now Alberta had a population of 63,000, in 1911 the population had increased to over 360,000, and in the census taken in July, 1916, it is estimated that the population is over 550,000. In 1912 and 1913 it was estimated that over 50 per cent. of the population were living in cities and towns. This percentage is altogether too high for an agricultural province, and labor problems should be a minimum quantity in Alberta.

As to the source of raw material, Alberta has an area of 225,285 square miles, nearly equal to the State of Texas. About 2 per cent. is occupied by lakes and rivers. Of the balance about 30 per cent. is in prairie and the balance is in park-like country and heavy timber. It has been estimated that there is over 1,000,000,000 cords of pulpwood in the province; of this approximately 20 per cent. is in poplar, 15 per cent. in tamarack and jack-pine and the balance in spruce of fair size.

This is enough to insure a plentiful supply for years to come, no matter how many mills are put in operation in the near future. All this pulp is within easy access of railroads. We have three transcontinental railways which offer good shipping facility to any part of Canada, the United States, Asia and Europe.

The power available in Alberta is almost unlimited, and could be developed as a side line in a good many instances and made to pay a handsome profit. If we enquire as to the amount available and the location we find that the South Saskatchewan River near Medicine Hat could develop between 40,000 to 50,000 horsepower. The Bow River now harnessed to 32,000 horsepower, used mostly in Calgary, has another 25,000 horsepower going to waste. The Red Deer River could be harnessed to 10,000 horsepower. This is located close to the town of Red Deer. It could be made the nucleus of a transmission system. At Edmonton the Edmonton Power Company is now proceeding with the construction of a 55,000 horsepower hydro-electric development on the North Saskatchewan River. Going still more to the north at the Grand Rapids on the Athabaska with a dam 150 feet high 250,000 horsepower could be developed. The Peace River, which is 250 miles northwest of Edmonton, could be harnessed to several hundred thousand horsepower.

The power required per $1,000 worth of pulp produced in a year is 17 horsepower. If we were to use only the river north of Calgary we would have enough power to operate any number of mills. It requires from 50 to 80 horsepower to produce one ton of mechanical wood pulp in 24 hours, so that our rivers if harnessed to mechanical wood pulp mills alone would furnish enough power to manufacture paper for the whole of western Canada and that part of the United States lying west of the Mississippi River.

Failing Wood Supply in United States

According to Mr. Pinchot, former chief of United States forestry, he estimated in 1913 that at the present rate of cutting the stand of spruce in the States of Maine would be exhausted in less than thirty years, New Hampshire twenty-five years, New York less than ten years, and Wisconsin has no reserve and manufactures nearly 300,000 tons a year. This is another factor that will cause our neighbor, the United States, to seek new sources of supply, specially those states west of the Mississippi River, and will force manufacturers to come and locate their mills in the Province of Alberta.

While spruce is the predominating wood in Alberta there is a large quantity of poplar in Central Alberta. This poplar should prove quite an attraction to those contemplating the manufacture of the better quality print paper such as used in books and magaines.

The Forest Product Laboratory of Canada informs me that the cost of installation of a ground wood pulp mill is generally calculated at $3,000 per ton per day of 24 hours.

Quoting from "Reciprocity with Canada" will give us a better idea of the growing importance of the export of pulp from Canada to the United States:

"Canada's preeminence as a source of our imports of pulp is due to the fact that practically all our imported mechanically ground pulp comes from that country, as well as a portion of our imports of unbleached chemical pulp. Our imports of unbleached chemical pulp, however, have increased with great rapidity since 1908. In that year we imported less than one and one-half million dollars worth, whereas in 1909 we imported nearly four and one-half million dollars' worth, and in 1910 nearly six million dollars' worth of unbleached chemical pulp, and of this total Canada furnished in 1909 about 30 per cent., valued at $1,334,820, and in 1910 only 21 per cent., valued at $1,241,179.

The following table shows the tremendous stride made from 1905 to 1910 in the manufacture and export of wood pulp in Canada.

Value of United States Imports of Wood Pulp of All Kinds by Year, from the Principal Countries of Origin, 1905 to 1910 Inclusive

(In thousands of dollars)

From—	1905.	1906.	1907.	1908.	1909.	1910
Canada	$2,669	$2,503	$3,230	$3,198	$3,407	$4,224
Germany	350	451	858	1,517	1,817	2,769
Norway	912	979	1,374	952	1,564	2,375
Sweden	396	461	499	1,060	1,318	1,641
Other countries	174	191	388	586	522	759
Total	$4,501	$4,585	$6,349	$7,313	$8,627	$11,768

This table shows us that if we had pulp mills in Alberta we would have a good market in the northwestern States, and the freight rates would play only a minor part, as they would be greatly in our favor.

Electric Railways

Street Railway Negative Return System for the Mitigation of Electrolysis*

By L. A. Herdt, M.Can.Soc.C.E., and E. G. Burr, A.M.Can.Soc.

With the rapid growth in the extent of electric railway lines and the traffic carried by them, the importance of providing a proper return of the current from the cars to the power houses and sub-stations and thus protecting piping systems, cables and other underground structures, against electrolysis, should be recognized by electrical railway engineers.

Serious corrosion of pipes, with attending damages, has occurred in various cities, as is well known, and efforts in certain instances have been made to eliminate the danger. However, it is a fact that as engineers are only human and liable to the error of advocacy, namely, seeing only one side of the question, the engineers of both interests, that is, the engineer of the company owning and operating the electric railway, and those of the company owning the underground structures, are still earnestly debating where to place the responsibility for damage done by stray currents. The often recurring result is that lawyers are brought into the debate and the courts become the stage of action. Judgment obtained after long delay is usually a legal compromise with orders for certain measures for the alleviation of the nuisance.

Such measures are rarely far reaching or fundamental enough to do more than remove the particular cause of complaint for a time. The merry-go-round of suit, judgments, expenditure on measures of aleviation and legal costs, and then recurrence of the trouble continues ad infinitum.

But as times change the street railway systems serving growing urban districts themselves include underground structures consisting of lead sheathed cables liable to destruction by currents straying from returns.

Thus a community of interest in the proper methods to avoid damage occurs, and the interest of all parties becomes the same. Engineers alive to the necessity of avoiding damage at the minimum cost may then be asked to apply the solution of the problem that will remove the trouble.

Various Methods of Electrolysis Mitigation

The various methods of electrolysis mitigation which have been for years the subject of discussion can be divided into two groups:—

(1) Those methods applicable to underground pipes and cable systems.

(2) Those applicable to the railway negative returns.

Of the various methods under the first heading, namely, chemical protection of pipes, cement coatings of pipes, insulating joints in piping systems, pipe drainage and cable drainage, none are entirely suitable for general use and cannot be considered as primary means of preventing electrolysis damage. These methods have their usefulness, but they are suitable only to special conditions and cannot be considered as important factors in any general plan for electrolysis mitigation.

Of the various methods covered under the second heading, that is, those applicable to the railway negative returns, such methods are suitable as will keep the track voltage gradient, that is, the voltage drop per 1,000 feet of track within certain limits, and will reduce the overall maximum difference of potential between any two points of the return system, also within limits, as well as those which will increase the resistance from tracks to earth. These methods are fundamental, as they control the cause of the straying of current from the tracks. Experience has shown what limits of track voltage gradient and overall potential differences can be allowed. Some ordinances grade the allowable limits to the density of the traffic; allowing greater latitude in the suburban districts than in the urban ones; for in fixing voltage limitations, the voltage limit prescribed should evidently be largely determined by the degree of development of the underground utilities in that district.

A track construction which results in a relatively high resistance of leakage path from rail to earth is eminently desirable, but difficult to provide in city streets with flush rails and paved streets.

In Great Britain, where the operation of electric railways is governed by regulations of the Board of Trade, regulation No. 3 requires that the maximum difference of potential between any two points on the track shall not be more than 7 volts, and also prescribes current densities in rails equivalent to a voltage gradient limit in the tracks to about one volt per 1,000 feet at peak load.

That is, it is sufficient to say that if the voltage gradient nowhere exceed one volt per 1,000 feet and the maximum difference of potential between any two points (reasonably remote from one another) on the returns, is not more than 7 volts—these readings taken at peak load—almost complete immunity from electrolysis damage will result. (The peak load is here considered to be the average of the readings for twenty minutes at peak load).

Under the conditions cited above, any residual current leakage, or electrolysis effect that may occur, can conveniently, properly and equitably be taken care of by the party owning the structures affected, by methods cited above under Class (1).

To reduce the track voltage drop in an electric railway system various methods are in use:—

(a) Improvement of condition of bonding of rail joints.
(b) Subdivision of load amongst sub-stations properly located.
(c) Installation of negative return feeders with the negative bus grounded at the station.
(d) Installation of negative return feeders insulated throughout their length and connected to the negative bus which is not grounded but is maintained at a potential lower than ground.

These methods have been applied in various ways.

In general methods (a) should be applied in all cases to the maximum practical degree of perfection.

Methods (b), (c) and (d) all aim at the same result.

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*Before C. S. C. E. Meeting.

namely, the taking of current from the tracks at an increased number of points.

Methods (c) and (d), however, are radically different from one another inasmuch as method (d) divides the system into a network of mains with separate feeders, whilst method (c) shunts the mains by so called feeders.

It will be found in general that method (c) will require a prohibitive amount of copper to reduce the track voltage gradient and overall difference of potential within the limits stated previously. A glance at Table I. will show that the current density in the return path through the track is so low, when calculated for the equivalent copper section of the rails, that any attempt to shunt the current will require excessively large copper conductors. For example, the conductance of a single track 100 lbs. rails is equivalent to about two million circular mills of copper and would require this amount added to shunt one-half of the current. If greater current densities are allowed the current will follow a shunt path through the earth and other underground structures. It may be here stated that the limits of 1 volt per 1,000 feet is by no means too low, and in congested districts where extensive underground structures are in existence this value may with great advantage be lowered.

In method (d), however, since the feeders are only connected to the tracks at its outer end and the negative bar is not connected to the tracks except through the insulated feeders, the voltage drop in them may be any value desirable, without reference to the above-mentioned track voltage gradient or overall difference of potential; and for this reason, the conductor section of the negative feeders can be decided by conditions of economy only. The potential gradients in the tracks depends entirely on the amount of current carried and where this becomes excessive the current is diverted through the feeder.

In a large electric railway system, if this is desirable, the potential gradient need not be entirely in the direction of the station, but may be reversed so that the integral of the gradients will give a low value of overall potenial differences.

Many railway engineers have claimed that the maintenance of such low voltage gradients as have been specified would require prohibitive expense in copper conductors for heavily loaded street railway systems such as are general on this continent. This is not the case, however. Such claims may be true when method (c) is employed, that is, when rails are shunted by the return feeder and the bus connected to ground; but the authors desire to point out that with the insulated return feeder system as outlined above and further described below, such regulations can be easily adhered to at reasonable cost.

The authors thought it would be interesting to the Society to discuss briefly the means by which the modifications of the track returns of a street railway system in Canada from method (c) to method (d) has resulted in a decided reduction of track gradients and overall potential difference, with a consequent disappearance of electrolysis trouble.

Design of the Return System

The return system of a street railway will be in the form of a network of conductors (the bonded rails) with loads at various points (the cars).

It is only required to consider the negative side of the system since the positive network of trolley wires, mains and feeders has no bearing on the problem with which this paper is concerned. The first step is, therefore, to prepare a plan of the system showing the car position at time of peak load, this data being obtained from the car operating schedules. Average values of current can be apportioned to each car, having due regard to the size of the car equipment and allowance being made for grades and curves, if considered advisable, the whole plan to form a representation of the way the load is distributed over the system.

From data such as that given in Table I. the resistance of the several parts of the returns can be obtained and the problem becomes a simple power engineering problem of the design of the network to carry the load within the stated limits of potential difference and voltage drop per thousand feet.

The rails from the network of mains and the current from the cars is collected on the network and returned through feeders connected to the station or stations.

It is advantageous at this point to consider the general line of development of a continuous current distributing system for light and power.

A direct current distribution system of small size will naturally take the form of a radial system with feeders run out to the nearest load and continuing therefrom as a main with the loads connected thereto.

The next development will take the form of cross tie mains connected to the ends of more than one feeder, then further cross mains are installed connecting the outer end of radial mains so that a network is constructed with the radial mains near the station, acting also as feeders to the outer cross tie main.

In larger systems radial mains cannot feed the outer districts within the desirable voltage regulation limits, and it is necessary either to install additional stations to feed the outer districts or special extra feeders to the outer districts with a means of providing for the extra voltage drop; or, again, the extension of the radial feeders to tap the mains or network at points further from the station, so that the current from the outer districts is taken from the radial mains at some intermediate point, and the current flows in the main from the nearest loads in a reversed direction.

The choice of method will resolve itself into a question of economics.

It is of special interest to note that in nowise would the alternative expedient of increasing the section of the radial mains be resorted to; as they are normally of large size, a large amount of copper would be required to moderately decrease their resistance, whereas in a feeder having only one point of connection to the load, that is, at the junction to the main, the voltage drop in it can be made any value desirable from consideration of power loss and current carrying capacity.

All the feeders can be designed with the same voltage drop, or if this requires excessive copper in the longer feeders, several bus voltages may be maintained at the station.

The return system of a street railway is strictly analogous to any other d.c. network system of distribution and is subject to the same economical limitations controlling the design.

It may be said, therefore, that such a system should consist of a network of mains formed by the tracks with feeders connected thereto in sufficient numbers and properly located to keep the maximum voltage difference between any two points on the track system and the voltage gradient in the track within prescribed limits, while allowing such voltage drops in the feeders as consideration of power loss and cost of copper may dictate.

The above line of development will, however, be open to the consideration of using an increased number of sub-stations instead of excessively long feeders, and the question itself becomes a further consideration of economic analysis with, however, the complicating condition of the advantages and disadvantages from an operating standpoint of an increased number of sub-stations.

A number of electric railway systems, the growth of which resulted in the occurrence of electrolysis with the original layout, were able to return to satisfactory conditions for a period of several years by increasing the number of sub-stations but conditions have become again unsatisfactory, to the authors' knowledge, due to further growth.

It is surely extraordinary that street railways, of all companies operating d.c. distributing network, should attempt to obtain close voltage regulation of their negative network by combining the function of main and feeder in one conductor, while experience in all other d.c. networks has shown the separate feeder and main system to be the only method capable of giving close regulation at anything but prohibitive cost.

It may be well to point out, however, that owing to mechanical considerations governing the minimum size of conductor that can be used in the form of the rail, lightly loaded systems may have considerable conductor capacity in the rail available for feeder purposes, and so it is only when this is used up by the growth of the system that trouble will commence. At this stage the provision of additional feeding points on the network is the logical line of development, and it is a matter of consideration of the specific case as to whether these are provided by feeders from the existing stations, or whether it is in any case desirable to first increase the number of stations. The final development of the system will require feeders from the sub-stations in any case, as sub-stations cannot economically be multiplied indefinitely.

In Table I. is given results of tests by the authors on rails bonded with electrically brazed bonds, and with some figures of interest calculated therefrom. It is interesting to note that with four double tracks of 100 lbs. rails with No. 0000 bonds meeting at the sub-stations, the maximum current that can be returned through them, without exceeding the 1 volt per 1,000 feet specified, is only 1,536 amperes corresponding to a sub-station of 921.6 kw. capacity at 600 volts.

Probably the majority of stations are not situated at the junction of four double tracks, and the conclusion is clear that the tracks should not be relied on to return all the current to the station. Further, from the same tables it will be seen that the tracks in the above example have an aggregate equivalent copper section of $2.07 \times 8 \times 10^6 = 16,560,000$ circular mils or 13 sq. ins., giving an equivalent current density of 118 amps. per sq. in. for the specified voltage gradient. It is clearly an uneconomical expedient to attempt to shunt these tracks by copper cables to maintain the specified gradient for returns to large stations.

If a feeder return system be installed, the feeders will be insulated and connected to the tracks at the outer end. The negative feeder system will then be operated with such voltage drop as may be economically desirable and long feeders may, if considered advisable, be operated with greater drop than shorter ones.

To provide the voltage necessary to drive the return current through the resistance of the feeder all the methods of ordinary d.c. distribution practice are available.

All the feeders may be designed for the same voltage drop, short feeders being provided with a series resistance to properly apportion the load over the whole number without using excessive conductor sizes for long feeders.

The method of design is to assume an appropriate value of voltage drop and then to calculate the feeder sizes required, checking up the current density in each feeder to determine the degree of utilization of the copper, and estimating total conductor cost and power loss for the purpose of economic design.

A number of these trial calculations will be made and from them it will become clear whether all feeders can be economically designed for the same voltage drop. If the station is located near the centre of the load, it will be generally found that a single value of feeder drop can be used unless the load is very uniformly distributed and the current to be returned is very large.

If the drop on all feeders is to be the same, no extra station equipment will be required unless the loss is increased, as with the negative bus insulated the voltage drop will be provided for by the generator voltage and the negative bus will attain a potential below ground equal to the drop in the feeders. A feeder to connect the tracks to the bus at the station will be used with a series resistance of sufficient size to limit the current to the safe value above referred to.

Usually it will not be necessary to insert resistance in any feeder other than that to the tracks at the station, all other feeders being proportioned in size to their load and length. If more than one value of feeder drop is desirable, multiplex bus operation with generators at different voltages may be adopted or boosters provided for the longer feeders, as the special circumstances may indicate.

If storage batteries are in use the resistance in the short feeder or feeders can be dispensed with and an end cell switch used to connect this feeder, so that the number of cells between it and the negative feeder bus may be changed as the load changes to maintain proper distribution of load on the feeders.

With a resistance, however, the feeder load distribution at varying load is automatically maintained unless the distribution of load on the system alters.

In some cases where the station is badly located with the centre of load some distance away, the single voltage arrangement with resistance may be applied for the load which is centered at the sub-station and heavy feeders run to the other centre of load. This feeder would require extra voltage for the line drop, and this could conveniently be provided by a series booster giving a voltage proportional to the load. If this feeder is large, it may be necessary to provide a system of sub-feeders properly proportioned at its far end to collect the current at a number of points of connection to tracks and so avoid excessive gradients as at the

TABLE I.

1000 Feet Single Track, 2 Rails Bonded

Rail Size [illegible]	Sp. Resistance [illegible] per ft. without Bonds	Res. in ohms with 00 B & S Bonds	Cir. Mils Equiv. Copper Section at 25 degs. C.	Amps. for 1 volt per 1000 ft. Gradient	Res. in ohms with 0000 B & S Bonds	Cir. Mils Equiv. Copper Section at 25 degs. C.	Amps. for 1 volt per 1000 ft. Gradient
50	20.40 10	.01027	1.05×10^6	97.5	.01016	1.065×10^6	98.5
60	16.65 10	.00854	1.265×10^6	117.0	.00844	1.28×10^6	118.5
70	14.59 10	.00741	1.46×10^6	135.0	.00731	1.48×10^6	137.0
80	12.75 10	.00647	1.67×10^6	155.0	.00637	1.70×10^6	157.0
90	11.66 10	.00590	1.83×10^6	170.0	.00579	1.87×10^6	173.0
100	10.21 10	.00532	2.03×10^6	188.0	.00522	2.07×10^6	192.0

station. A resistance may be used here also in this shortest sub-feeder to good effect in most cases. If the feeder can be terminated at the intersection of two double tracks well cross bonded, the sub-feeders will seldom be required.

The series booster can also be conveniently used for cases where the station is properly located, but a single voltage method would require large section for several long feeders to outlying districts. Such a booster will maintain proper distribution of load between short feeders and long ones, automatically with varying load as long as the general distribution of the load is unchanged, and at time of light load can usually be shut down altogether. It is important to have series divertors or traps on the series feeder of the booster to allow of adjustment of the booster voltage at full load to take care of periodic change of distribution of load on the system.

It may be here stated that the pressure wire from tracks to station is an indispensable part of the negative feeder return system as indicating the actual potential conditions of the track, and with booster operation the indications of the track potential differences allow of complete control from the station.

With a system of negative feeders and only a part of them boosted, it is entirely feasible in the majority of cases to operate the booster only at peak load, as the feeders will return a considerable current even with the booster shut down. The voltage indications given by the pressure wires will be a sure guide to the operation of the booster.

Continuous Brake Power and Its Application to Electric Railway Trains

A paper on the "Continuous Power Brake and Its Application to Steam and Electric Railway Trains" was read by Mr. A. B. Brown at the Montreal electrical luncheon on April 4. Mr. Brown, who has been for twenty years in the service of the Westinghouse Brake Company, briefly outlined the development of the air brake, stating that the first successful continuous power brake was invented by Mr. George Westinghouse. The invention of what is known as the straight air brake was completed in 1869, but in actual service the brake developed a serious fault, namely, in case of the bursting of an air hose, between the cars, or rupture of piping under any of the cars, resulted in a complete failure of the entire system. Mr. Westinghouse later invented the plain automatic brake, and up to 1880 the application of such power brakes was confined to passenger service. In 1880 the freight car brake was designed.

In 1886 and 1887 the Master Car Builders' Association carried out a series of tests so as to decide the question of a standard type of freight brake. During the first year of these tests the committee of the association declared that it would be dangerous to use any of the systems offered for trial, and predicted that the only safe brake for long trains was one that was set in action by electricity; in fact, the Westinghouse Company had to resort to electricity to complete their tests that year with credit. The refusal of the committee to sanction the use of any of the then existing brake systems on freight trains was due entirely to the slow action of those systems, in case of necessity for an emergency stop, the most prononuced result of slow action being a serious and damaging shock to cars and lading. Most of the competitors came to the conclusion that long trains, regardless of the speed, required such rapid action of brakes throughout their entire length that air was too sluggish and electricity must be used.

Electro-pneumatic brakes were made and tried, and for the time being purely pneumatic brakes were dropped from consideration by most people. All know the repugnance which existed at that time in the minds of railway men to the use of electrical devices for railroad trains, and this illustration will show that the great need for rapid action of the brake on long trains was appreciated. But Mr. Westinghouse was not dismayed, his experiments having indicated that waves of air within the brake pipe could be created and made to travel as rapidly as sound, namely, 1,100 feet a second, in addition made to do useful work, and he finally succeeded with the perfection of what is popularly known as the quick-action triple valve, in making each brake in the train assist in applying the succeeding brake, just as in the case of a row of bricks standing on their end, and close together, the falling of one brick results in knocking down the next in the row. The resulting action was not equal in quickness of application to the electro-pneumatic brake, but it brought the wholly pneumatic brake just within the admissible limits. Thus the development and use of the electro-pneumatic brake received a serious set-back for the time being.

As early as 1891 some of the electrically-operated railways considered the application of air brakes to their cars, and the Gennet Air Brake Company of Chicago was the first company to enter this field, they supplying a straight air brake with a single cylinder, double acting pump, driven from an eccentric mounted on one of the car axles.

After considerable experience with the axle-driven type of compressors they gradually gave way to the now well-known motor-driven type of compressor, because of difficulty in maintenance and reduced capacity, when cars were operating at low speeds within city limits, when frequent stops were made, and air consumption the heaviest.

In the meantime the development of high-speed inter-urban railways had progressed with marvellous rapidity, particularly in the States of Ohio and Indiana, and the majority of the roads adopted the highest class of steam railway practice in the construction of their permanent way.

In the year of 1904 three million, two hundred and seventy-five thousand inter-urban passengers were carried into and out of the city of Indianapolis, and in 1910 the number reached five million, five hundred thousand. In order to surround the travelling public with the necessary factors of safety, the straight air gave way to the automatic brake, but on account of the more exacting conditions in this service it was found that the ordinary steam roads' automatic brakes were not adaptable, only after considerable modification, for not only must they perform effectively as safety appliances, but they have become an indispensable factor in profitable transportation, although this necessity has been comparatively recently identified, and differentiated from their function as safety appliances.

During the year of 1897 there occurred one of the most important developments in connection with electric railway operation, Frank J. Sprague having conceived the idea of remote control of all motors under a train of motor cars, and in so doing prepared the way for the wonderful results (in the way of handling large numbers of passengers) since accomplished by the operation of motor car trains in Chicago, New York, and Boston.

After giving some figures showing the immense development in subway traffic, Mr. Brown proceeded: The length of express trains had been increased to ten cars and local trains to eight cars, and it was at this point that electricity came into its own, as an actuating medium, in connection with the operation of train brakes. By the use of electricity controlled by the motor man, in conjunction with his regular brake valve, for energizing magnet valves, which in turn admits and exhausts compressed air from brake cylinders under each car, the time of ordinary station stops was reduced one-half and emergency stops from speeds of forty miles an hour reduced from six hundred and fifty to three

(Concluded on page 36)

The Dealer and Contractor

Toronto Electrical Contractors' Association Constitution and By-Laws. Committee Now Arranging Date of Meeting for Election of Officers

CONSTITUTION

ARTICLE 1

This Association shall be called the Toronto Electrical Contractors' Association.

ARTICLE 2

The objects for which this Association is formed are to foster trade among the electrical contractors; to reform abuses and to secure freedom from any unlawful and unjust exactions; to settle differences between its members; to promote more enlarged, friendly, and social intercourse between its members; and to diffuse accurate and reliable information among its members as to the standing of merchants, builders, and others engaged in the erecting of buildings or the furnishing of electric materials therefor.

ARTICLE 3

The officers of this Association shall consist of a President, Vice-President, Secretary-Treasurer, and an Executive Committee consisting of above officers and two additional members, all of whom shall be elected at the annual meeting.

ARTICLE 4

The membership of this Association shall consist of electrical contractors as defined in the succeeding paragraph.

The term "Electrical Contractor" shall include all persons, firms, or corporations carrying on the business of installing electrical apparatus for incandescent and arc lighting, and the installation of all electrical machinery, wiring, and switchboard construction used by or in connection with electric lighting, heating, and power services, and other branches of electrical work, including the retailing of electrical supplies, such forming the principal and fundamental portion of their business.

All applications shall be passed upon by the Executive Committee.

Each member present at any meeting shall be entitled to one vote.

ARTICLE 5

(1) The officers of this Association shall be elected by a ballot at the annual meeting in May of each year.

(2) The term of President, Vice-President, Secretary-Treasurer, and two other members of the Executive Committee shall be one year, or until their successors are elected.

(3) The President shall appoint two members to act as Tellers at the election.

ARTICLE 6

Any vacancy that may occur among the officers shall be filled for the unexpired term at the next meeting of the Association by ballot.

ARTICLE 7

(1) Applicants for membership shall be required to have been in business for at least one year, and to carry a stock of material suitable for the conduct of their business, unless such requirements are waived by a vote of the Association.

(2) No electrical contractor who is a member of any electrical jobbers' association, or is a jobber, shall be eligible to membership in this Association. Any member of this Association joining any electrical jobbers' association, or entering into the business of a jobber, shall, by such action, terminate his membership in this Association.

(3) Members who change the character of their business, so that they cease to fulfil the requirements of Article 4 of the Constitution, shall be dropped from the roll, provided the facts are established to the satisfaction of the Association.

ARTICLE 8

(1) Conditions and amendments to the Constitution must be submitted in writing to the Secretary, who must then mail copies of the same to each member. This must be done at least one week before the meeting of this Association is to be held.

(2) All conditions and amendments to the Constitution must be carried by a two-thirds vote of the members present.

BY-LAWS

ARTICLE 1

The regular meetings of the Association shall be held monthly on the night most convenient as determined by the Organization Committee, and at 8 p.m. Special meetings must be called by the President at the written request of three members. The place and hour shall be given by the Secretary in his notice to members previous to the meeting.

ARTICLE 2

After the meeting has been called to order, by the presiding officer, the following order of business will be observed:—

1. Calling of the roll.
2. Reading the minutes of the previous meeting.
3. Communications and bills.
4. Proposals for membership.
5. Election of new members.
6. Reports of officers.
7. Reports of committees, and action thereon.
8. Collection of dues and fines.
9. Miscellaneous business.
10. Election of officers.
11. Suggestions by members.
12. Adjournment.

The proceedings of the meetings shall be conducted in accordance with Cushing's Parliamentary Rules.

ARTICLE 3

Duties of the President shall be to preside at all meetings of the Association and to direct that all the minutes of all meetings and all reports of Committees be read; and, with the consent of the Executive Committee, to appoint special committees.

ARTICLE 4

The Vice-President, in the absence of the President, shall have the same power and authority that the President possesses when present; and in case both the President and Vice-President are absent, the members assembled at any meeting may elect a president pro tem.

ARTICLE 5

Duties of the Secretary-Treasurer shall be to keep a correct journal of all proceedings; to present for consideration all communications which may be received; to read such reports and records as may be ordered by the President; to collect all dues, fines, assessments, and contributions, giving receipts for the same; to take charge of all funds of the Association, and to dispose of the same as the Association may direct; to pay bills against the Association when properly vouchered and countersigned by the President; to keep accurate accounts subject at all times to investigation by the Association, and to make a written statement of all receipts and disbursements at each Annual Meeting.

The Secretary-Treasurer shall furnish a bond of one thousand dollars ($1,000.00) for the faithful performance of his duties, the cost of such bond to be paid by the Association.

ARTICLE 6

(1) The Auditing Committee shall consist of two members, elected at the Annual Meeting, who shall examine the books of the Secretary-Treasurer for the ensuing year.

(2) Their term of office shall be one year, or until their successors are elected.

(3) It shall be their duty to present a written report of the results of their examination to the Annual Meeting of the Association.

ARTICLE 7

All officers of the Association shall serve without salary.

ARTICLE 8

The membership fee shall be $25.00 and shall accompany the application, and the annual dues shall be $15.00 per year for each member, and shall be payable in advance on or before the date of the Annual Meeting. The fiscal year shall be from May 1st to April 30th inclusive.

Applicants shall pay the annual dues of $15.00, but after August 1st applicants shall pay for the remainder of the fiscal year at the rate of $1.50 per month. The membership fee shall be $15.00 on applications to July 1st, 1917.

ARTICLE 9

No member having an unsettled account standing against him on the books of the Association for sixty days, shall have any vote or other privilege of membership, until the account is settled, and any such member may be dropped from the roll by a majority vote of the members of the meeting.

ARTICLE 10

Three or more members shall constitute a quorum for the transaction of any and all business at any regular or special meeting of this Association.

Members may vote in person only.

ARTICLE 11

(1) If any member is charged with violating any article of this Constitution and By-laws as far as printed, or such as may be hereafter added, his case shall be submitted to a regular or called meeting, and if he is found guilty, he shall be fined or expelled by a majority vote of the members present in said meeting.

(2) The members shall, however, have the right to an appeal to the next meeting of the Association, and the said question shall be finally decided by a majority vote of the members present.

ARTICLE 12

These by-laws can only be amended in the same manner as heretofore prescribed for amendments to Constitution; but any part of the same may, for a particular purpose, be suspended for the time being by unanimous consent of the members present at the meeting.

ARTICLE 13

It shall be the duty of the Executive Committee to take charge of the affairs of the Association not otherwise provided for.

Where Electricity Can Be Used on the Farm

Farmers are constantly hearing of the advantages of electricity on the farm, what it will do for them and its wide application. Some of this has been rather vague, and the Society for Electrical Development has prepared a list of some 104 applications appended here. Of course, every farm will not find it economical to install all the equipment listed, but every farm will find profitable use for some of it. Some of the applications can be handled best by a community of interests; for instance, electric threshing and harvesting machinery; hulling machinery; oil concentrating plants; hay balers, etc. High priced machinery used only for short periods during the year is applicable to this community treatment:

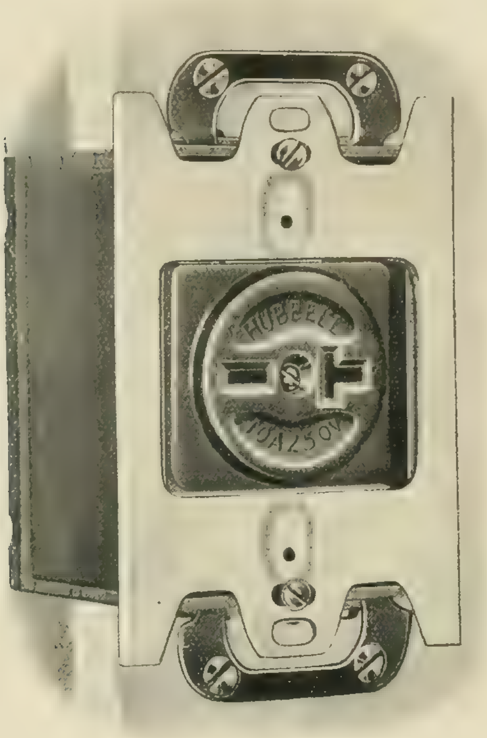
Where Electricity Can be Used on the Farm

- Oat Crushers
- Alfalfa Mills
- Horse Groomers
- Horse Clippers
- Hay Cutters
- Clover Cutters
- Corn Shellers
- Ensilage Cutters
- Corn Crackers
- Branding Irons
- Currying Machines
- Feed Grinders
- Flailing Machines
- Livestock Food Warmers
- Sheep Shears
- Threshers
- Grain Graders
- Root Cutters
- Bone Grinders
- Hay Hoists
- Clover Hullers
- Rice Threshers
- Pea and Bean Hullers
- Gas-Electric Harvesters
- Hay Balers
- Portable Motors for running Threshers
- Fanning Mills
- Grain Elevators
- Huskers and Shredders
- Grain Drying Machines
- Binder Motors
- Wheat and Corn Grinders
- Milking Machines
- Sterilizing Milk
- Refrigeration
- Churns
- Cream Separators
- Butter Workers
- Butter Cutting-Printing
- Milk Cooling and Circulating Pumps
- Milk Clarifiers
- Cream Ripeners
- Milk Mixers
- Butter Tampers
- Milk Shakers
- Curd Grinders
- Cassin Grinders
- Pasteurizers
- Bottle Cleaners
- Bottle Fillers
- Concrete Mixers
- Cider Mills
- Cider Presses
- Spraying Machines
- Wood Splitters
- Auto Trucks
- Incubators
- Hoovers
- Telephones
- Electric Bells
- Ice Cutters
- Fire Alarms
- Electric Vehicles
- Electro Cultures
- Water Supply
- Pumping
- Water Sterilizers
- Fruit Presses
- Blasting Magnetos
- Lighting
- Interior Telephones
- Vulcanizers
- Pocket Flash Lights
- Ice Breakers
- Grindstones
- Emery Wheels
- Woodsaws
- Forge Blowers
- Drop Hammers
- Soldering Irons
- Glue Pots
- Cord Wood Saws
- Egg Testers
- Burglar Alarms
- Bell Ringing Transformers
- Devices for Killing Insects
- Machine Tools
- Molasses Heaters
- Vacuum Cleaners
- Portable Lamps to attract Insects.
- Toasters
- Hot Plates
- Grills
- Percolators (Coffee)
- Irons
- Ranges
- Toilette Articles
- Water Heaters
- Fans
- Egg Boilers
- Heating Pads
- Dish Washers
- Washing Machines
- Curling Irons

What is New in Electrical Equipment

Special Aligning Plate

When installing flush plug receptacles it has been the general practice to use the brass flush plate as a medium to bring the receptacle itself into alignment with the surrounding trim. If after attaching the flush plate it was found that the receptacle was out of line it was then necessary to remove the plate and adjust the receptacle. Long standing objections have been raised to this round about method necessary to properly align receptacles, and the Harvey Hubbell, Inc., have now brought out a receptacle of the Hubbell standard interchangeable type equipped with a special aligning plate of novel design. The use of this combination makes it possible to secure positive alignment before attaching the brass flush plate. Eliptical slots in the aligning plate, through which the screws pass to the outlet box, allow free movement for aligning and adjusting to wall variations. This plate overhangs the edges of the outlet box and fits flat against the wall, as illustrated in the figure, giving greater security to the receptacle and increased rigidity to the struck-up flush plate. An added feature, the value of which will be recognized by all contractors handling large building operations, is the protection from dust and dirt this aligning plate affords the outlet box and receptacle plate while the building is under construction.



Addition to Factory of Electrical Concern

In preparation for the prosperous times which the company anticipates will prevail after the close of the war, the Standard Underground Cable Company of Canada, Limited, is making an addition to its factory at Hamilton, Ont., which when completed and equipped with the necessary machinery will represent an investment of $50,000. The illustration [illegible] the addition with a portion of the former factory in the background to the right, the new part extending about to the point where the car is to be seen standing on the switch. The new structure consists of one storey, with basement built, built of brick and concrete, and is 125 by 120 feet in dimension, which gives a total increase in floor space of 30,000 square feet. It is most modern in type and equipped to secure the lighting, heating, and ventilation necessary to the best working conditions. Ample fire protection apparatus is also provided for, which includes a complete automatic sprinkler system. The architects are Prack & Perrine, of Hamilton.

The new building will be devoted exclusively to the uses of the wire-drawing department, and, in addition to housing the former equipment, will contain material additions of new machinery of the latest design capable of drawing wires ranging in size from No. 40 B. and S. gauge, which is about the thickness of a hair, to the largest size of trolley wire; also machines for grooving trolley wire and for rolling flats and squares such as are used in the manufacture of magnet wire. There will also be two new "Bright-annealing" furnaces for annealing or softening the wire after it has been drawn. This addition will not only give room for a considerable increase in the output of the wire-drawing department, but the space released will allow for expansions in the stranding and cabling departments.

All of the machinery in the new plant will be electrically operated by three-phase alternating current motors of 550 volts, 25 cycles, the current being furnished by the Hamilton Hydro-Electric Department and carried from the overhead transmission lines to the transformers on the company's property by underground cables. Power is now taken for other uses in the plant from the Dominion Power and Transmission Company.

This increase in the manufacturing capacity of a plant erected just six years ago and still modern and highly efficient, considered in connection with the excellent rail and water shipping facilities afforded by its being located on two great railway trunk lines and on the shore of Lake Ontario puts the Standard company in a splendid position to meet promptly the electric wire and cable requirements of its customers, both domestic and foreign.

Addition to factory of Standard Underground Cable Co.

The town council of Watford, Ont., have purchased a site and plans will be prepared for a transformer station to cost $3,000.

Radieye Attachment Indicates Switches

One of the latest contributions of science to the convenience of householders is the "Radieye" attachment for pull socket chains flush plates manufactured by the Canadian General Electric Company. This attachment instantly locates switches in dark room by means of luminous rays emitted from it. The luminant is claimed to be a composition containing radium. This guarantees that the light is permanent, as radium retains its active properties for hundreds of years. The luminous body is protected by glass and the attachment itself has a brass body, which affords additional protection.

Fig. 1.

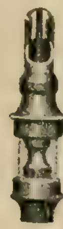


Fig. 2.

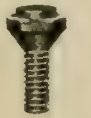
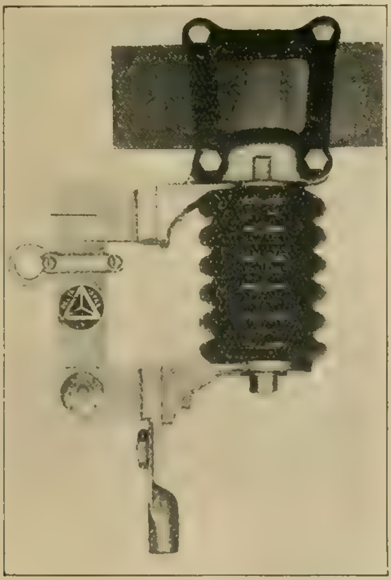


Fig. 3.

If used with a pull chain attachment, the "Radieye" device, Fig. 2, is substituted for the usual ball at the end of the chain. When used with a flush plate switch the "Radieye" device, Fig. 3, is substituted for one of the screws which attach the plate to the wall.

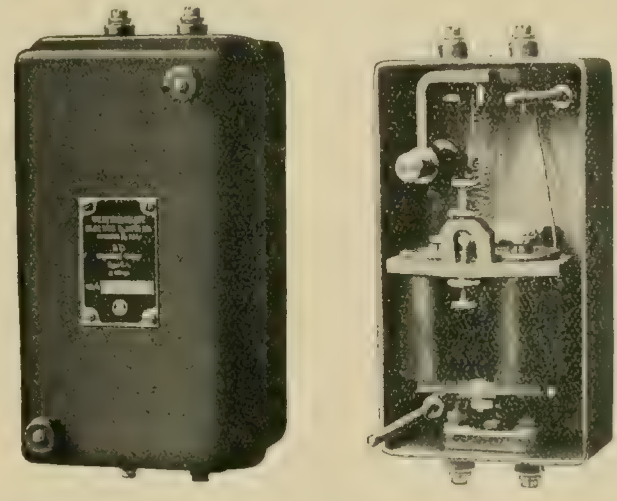
Bus Type Disconnecting Switches.

As central station capacities increase, additional precautions must be taken to guard against accidents which will cause complete shutdowns. A practice rapidly growing in favor is to place disconnecting switches in series with the bus bar side of high tension oil circuit breakers or switches so that when it becomes necessary to adjust or inspect the breaker mechanism this can be accomplished without danger to the operator. Another useful feature is that, should the oil breaker prove defective or develop short-circuits within itself, the trouble can be localized by opening the disconnecting switches. The switch illustrated is made by the Delta-Star Electric Company, Chicago, Ill., and designed to clamp or mount directly on the bus, thus securing a high space factor. The adjustable contact and holding clamp enables the switch to be so located that a short run is secured to the oil switch terminal.


Bus type disconnecting switch, 3300 volts.

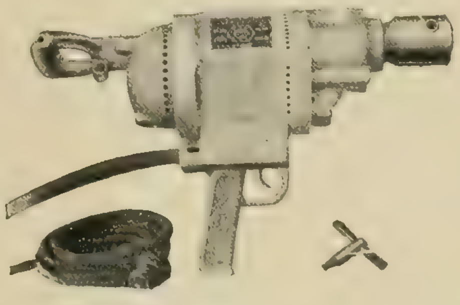
Westinghouse Direct Current Overload Relay

The relay illustrated has been developed by the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., to give overload protection on direct current circuits. It is particularly applicable for use in connection with three-wire generators having but four cables running to the switchboard, as by connecting the control coil of the relay to ammeter shunts, the circuit breakers can be mounted on the switchboard, yet controlled by the actual armature current as required by the Fire Underwriters. Without the relay the circuit breaker must be inserted in the circuit at the position of the ammeter shunt. This would require either that the circuit breaker be mounted at the generator, away from the switchboard, or that an extra pair of leads be run from the generator to the switchboard.



Electric Drill with Special Control

A special control which is designed to prevent the breakage of small drills when operating the close-corner electric drill is shown in the accompanying illustration. The operating scheme is similar to that of an automatic pistol, one finger doing the work. The grip need not be released to turn the switch or push in or pull out the handle at the moment the drill breaks through. The housings are cast from an aluminum alloy having a high tensile strength and resistance to distortion. The chuck is strong and rigid in design. The motor is of special design, and made by the Robbins & Myers Company. The commutator and brushes are readily accessible by removing four screws, which enables the top to be slipped off. This cover does not carry the armature shaft bearing. This bearing and brushes are carried by an inner spider, which is protected from external injury or



strains, tending to bind the bearing. Furthermore, this construction allows the drill to be run while the cover is removed for inspection of the brushes and commutator, which is a great practical advantage to the upkeep of the tool. The Northern Electric Company is the exclusive Canadian distributor of this outfit.

Contractors' Helps

The Society for Electrical Development have issued a very interesting booklet which contains a series of selected newspaper advertisements, illustrations, circular letters and lantern slides which can be used most effectively by central stations and contractors in securing the wiring of old houses. The Society has left nothing undone in this respect to prepare attractive ads that will bring in business. They are designed to sell not only electric lighting, but also electric service—the idea of how much better the electric way is than the ordinary way. These ads are designed to plow the field, so to speak, to put people in a receptive mood for your salesmen—to get people into the habit of saying, "I never thought of that." The booklet contains some very excellent selling arguments.

The Mica Company of Canada, Limited, advise that the growth of their business has necessitated the transfer of their executive offices from Montreal to Hull. The future address will be P. O. Box 156, Hull, Que.

Hydro-Electric Radiation, Ltd., announce that they will in future be known as Electric Steam Radiation, Ltd. The address remains the same—21 Richmond Street West, Toronto.

Personal

Mr. A. M. Tirbutt, on April 11th, read a paper on "Electric Furnaces," before the Electrical Section of the Manitoba Branch of the Canadian Society of Civil Engineers.

Mr. H. Baron, who has been electrical superintendent at Stettler for the past two years, has been appointed chief engineer for the town of Camrose, and assumed his new duties there about the 20th of April.

Mr. Frank Kennedy, who has been assistant manager of the Toronto office of the Bell Telephone Company, has been appointed Toronto manager following Mr. Kenneth R. Dunstan, who is taking charge of the Ontario division.

Mr. F. C. Thoms has resigned as superintendent of the Canadian Tungsten Lamp Company, to be reassociated with the Westinghouse Lamp Company, at Bloomfield, New Jersey. Mr. Thoms is succeeded by Mr. D. A. Sprinthal, formerly of Bryan-Marsh Company, who has had extended experience in lamp manufacture.

Mr. W. S. Rugg, formerly district manager of the New York office of the Westinghouse Electric and Manufacturing Company, succeeds Mr. C. S. Cook as manager of the railway department, with headquarters at East Pittsburg. Mr. E. D Kilburn, manager of the power department of the New York office of the company, has been appointed to succeed Mr. Rugg. Mr. E. P. Dillon succeeds Mr. Kilburn.

Mr. Sydney F. Ricketts, A.M.I.E.E., has joined the staff of the Canadian General Electric Company, Toronto office. He was with the Ross Rifle Company until the government took over the factory, and has also had a very interesting engineering career in England, China and Canada. Mr. Ricketts was a Finsbury College student under Prof. Silvanns Thompson, and was engaged in traction work for some years in London. He spent eight years in electrical engineering in China and has been in Canadian professional life for the last six years.

Trade Publications

C.G.E. Publications—Electricity in rubber mills, bulletin No. 48022; Miners' Electric Lamps, bulletin No. 43702

Out-door Sub-stations—Bulletin No. 30, completely illustrating and describing high tension outdoor sub-stations and equipment, manufactured by the Delta Star Electric Company, Chicago.

Wiring Devices—Catalogue No. 14, issued by the George Cutter Company, South Bend, Ind., illustrating and describing in detail this company's complete line of electrical lighting and wiring devices.

C. G. E. Publications—Holophane Decolite—price list of date December 4, 1916; Holophane Reflectors and Fittings—pamphlet containing various charts and tables relative to the use of this equipment.

R & M Breeze—The Robbins & Myers Company, Springfield, Ohio, have issued the initial number of the R & M Breeze which is to be the official factory organ of that company and will be published twice a month.

Semi-Indirect Holder—Bulletin No. 100, by the MacBeth Evans Glass Company, describing a recently invented semi-indirect bowl holder, which makes it possible to transform the ordinary direct lighting fixture, in which the lamps are suspended vertically, into an attractive fixture with individual semi-indirect lights.

Metal Moulding—The National Metal Molding Company have issued a number of new bulletins, including No. 151 on non-metallic flexible conduit; No. 50 on rigid steel conduit and No. 350 on locknuts and bushings. These bulletins are well illustrated and contain a quantity of useful information regarding the company's products. It is noticeable that each of these bulletins is bound in a correspondence folder, properly indexed for filing either according to the material or the name of the manufacturer, and of a size to fit standard, vertical letter files. The company have inaugurated this innovation as the filing of catalogues has always been a considerable problem.

Continuous Brake Power and Its Application to Electric Railway Trains

(Concluded from page 31.)

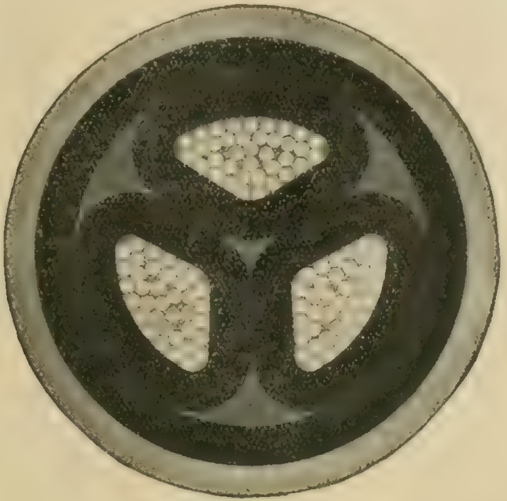
hundred and fifty feet, which permitted the shortening of signal spacing, the result of these improvements being that the capacity of the subway was increased considerably.

The experience of the brake manufacturer in this field has shown that on account of the nicety and quickness of electrical control of air-operated train brakes motormen do things which could not possibly be attempted with the types of purely pneumatic brakes, a condition that at once suggests the absolute necessity of improving and incorporating every known safeguard in the pneumatic side of the brake, before permitting the addition of electrical features, in order to uniformly insure the smallest possible difference in length of stop between what can be accomplished when electrical features are in use, and in case of their unexpected failure to act at some critical time when responsibility for bringing the train to rest would then devolve on the pneumatic portion of the brake alone.

As an illustration of what has been accomplished by the modern electro-pneumatic brake, it might be stated that in some breakaway test at speeds of approximately 60 miles an hour a steam road car weighing 125,000 pounds was stopped in 15.6 seconds, the decelleration being at the rate of 3¾ miles per hour per second. In performing this work there was exerted a retarding force of approximately 325 pounds per ton, which is the equivalent of about 1,275 h.p., or a total of 900 B.t.u's per second.

Toronto Hydro Electric

orders another eight miles of



PHILLIPS CABLE

Here is strong endorsement of the quality and serviceability of Phillips heavy duty cable. The Toronto Hydro Electric System recently sent us a repeat order for the supply and installation of 8 miles of 250,000 C.M., 3-core, 13,200 v. cable, illustrated above. After installing miles of our product and giving it a most thorough testing in actual use, this re-order is conclusive evidence of the opinion of "T.H.E." experts. Phillips Cable will give you the best of service for power, telephone, lighting, railway or special use.

Write us for further details.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver

Phillips Factory at Montreal

Current News and Notes

Aylmer, Ont.

A by-law was submitted to the electors of Aylmer, Ont., on April 30, asking authority to enter into an agreement with the Hydro-electric Power Commission of Ontario.

Brantford, Ont.

The Hydro-electric Commission of Brantford, Ont., announce a reduction in light and power rates. The domestic charge will now be two cents per kw.h. in place of two and one-half; commercial 4½, in place of 5; power 1.67 in place of 1.9. The domestic reduction is 20 per cent., commercial 10 per cent. and power 13 per cent.

Clinton, Ont.

A ten per cent. reduction is announced in domestic and commercial lighting at Clinton, Ont., which is served by the Hydro-electric Power Commission of Ontario.

Greenfield Park, Que.

With one exception, all the contracts for materials for the street and house lighting system of Greenfield Park, P.Q., have been let. The area to be covered is about eight miles, and the work is now to be done by contract. The following are the contracts let: Sangamo meters, Northern Electric Company, Montreal; Ferranti pole type transformers, Harland Engineering Company, Montreal; line material, Northern Electric and Canadian General Electric Companies; Adams Bagnall constant current transformers, Northern Electric; Pemco brackets, A. H. Winter Joyner, Ltd., Toronto; poles, Harris Tie & Timber Company, Ottawa.

Hamilton, Ont.

A reduction to commercial light and power users in Hamilton, Ont., has been granted by the Ontario Commission. Power customers will receive a 20 per cent. reduction and light users probably 15 per cent.

The March meeting of the Hamilton Cataract Power, Light & Traction Company Section of the N.E.L.A. was held on Thursday, the 22nd of March, with a very good attendance. President C. H. Fry presided. A good musical programme was rendered and cigars were passed around. A lecture, illustrated with lantern slides, was given by Mr. Geo. D. Richmond. A very enjoyable evening was spent by all present.

London, Ont.

Tenders will be called shortly for an addition to the Horton Street sub-station to house additional transforming capacity.

Montreal, Que.

The Bell Telephone Company have established an Employees' Benefit Fund to provide pensions, accident and sickness benefits and benefits to dependents of deceased employees.

The Howard Smith Paper Mills, Ltd., have under consideration the installation at Crabtree Mills, P.Q., of an additional hydro-electric unit. This includes twin horizontal water wheels of 11,000 h.p. capacity, 180 r.p.m., working under a 30-foot head.

In connection with the extensive additions to the steam generating plants and sub-stations now being carried out by the Montreal Tramways Company, an order has been placed with the Canadian General Electric Company, for a steam turbo-generator of 12,500 kw. capacity at 80 per cent. power factor, to be installed in the new power station at Hochelaga. This is to be delivered in April, 1918, and is the second machine of this capacity ordered by the Tramways Company. The programme of the company includes new sub-station, additional equipment, and a conduit system linking up the various plants.

Niagara Falls, Ont.

Work has been started on the Chippewa-Queenston power canal. The construction of a double-track railway for material transportation will begin very shortly.

It is stated that negotiations are in progress between the Ontario Hydro-electric Power Commission and the Ontario Power Company for the purchase of the latter company's plant.

Orillia, Ont.

According to a report of the Hydro-electric Commission there was a surplus of $40,256 on the Severn system for the year 1916. The Wasdell Falls system showed a gross surplus over operation costs of $4,569. The Eugenia plant operated at a deficit of $12,120.

Stettler, Alta.

The electric light plant, which commenced a 24-hour service in October, 1915, as an experiment, has now established the day service as a permanency. The output for 1916 was 173,334 kw.hrs., an increase of over 44,000 kw.hrs. in 1915, while the operating costs were reduced from 7.6 cents to 6.6 cents per kw.hr. with a profit of $3,560 on the operating account, and the town is contemplating a reduction in the lighting rates of 2 or 3 cents per kw.hr.

Winnipeg, Man.

According to a statement recently submitted to the Winnipeg board of control, the city's hydro-electric plant had a surplus of $158,763.89 at the end of February on income account. The surplus for the ten months of the fiscal year up to that date was $79,073.32. The total revenue for the month of March was $92,925.42, and the operating expenses $78,147.94, leaving a surplus of $14,777.48 for that period.

Woodstock, Ont.

The Hydro-electric Power Commission of Ontario are reducing the cost of power delivered at Woodstock, Ont., from $23 to $21, which will result in a proportionate reduction to Woodstock consumers.

300%
STRONGER THAN
ACID FLUX

and cleans the wire or metal without biting the surface. Can't start corrosion nor reduce capacity of the wire. That's

ALLEN
Non Acid Sodering Flux.

[illegible]

Sample for your Dealer's Name.

Houston & Co., Ltd., Cumberland Block WINNIPEG

22 College Street, Toronto.

1825 Scarth Street, Regina.

[illegible]

Electrical News
Generation, Transmission and Application of Electricity

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ADVERTISEMENTS
Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Vol. 26 **Toronto, May 15, 1917** **No. 10**

By-law Respecting Unsafe Electrical Appliances

We are reproducing below a copy of the city of Winnipeg by-law, just passed, relating to the sale of unsafe electrical appliances or material. The city was given special power by the provincial legislature at its last session to deal with this matter, as it had become increasingly evident that many appliances were constantly being placed on the market in which the factor of safety was not sufficiently provided for. Mr. F. A. Cambridge, city electrician, to whom we are indebted for a copy of this by-law, expects that through their new powers they will be able to keep the danger element at the lowest possible point, at the same time protecting those conscientious manufacturers who maintain the proper standard. We understand that action has already been taken in regard to certain key sockets and plug clusters of foreign origin, which has demonstrated the necessity for such powers, as the unrestricted sale of this equipment was introducing serious hazards.

A By-law of the City of Winnipeg Relating to the Sale of Electrical Appliances

The Municipal Council of the city of Winnipeg, in council assembled, enacts as follows:

1. No person, firm, or corporation shall sell, offer for sale, or install any appliances, apparatus, or materials for use with electric current that may be unsafe.

2. The City Electrician of the city of Winnipeg is hereby empowered to inspect any or all appliances, devices, or material that are exposed for sale or carried in stock for the purpose of sale or installation by any person, firm, or corporation in the city of Winnipeg, and which are designed or intended for connection to or with any electric light or power circuit in the city of Winnipeg, and in the event of said City Electrician, upon examination or inspection, finding any such device, appliance, or material is, in his opinion, likely to be a source of danger to persons or property, he is hereby empowered to notify in writing the person, firm, or corporation exposing or offering such device, appliance, or material from sale, or to refrain from installing the same.

3. No person, firm, or corporation, after receiving a written notice signed by the City Electrician, that any electric device, appliance, or material in his or their possession is unsafe, shall expose such device, appliance, or material for sale, or shall attempt to install such an appliance, device, or material, unless and until the same has been altered so as to comply with the requirements of the City Electrician making the same safe, and his written approval thereof obtained.

4. Any person, firm, or corporation may appeal to the Public Utilities Commission from any order or direction of the City Electrician, provided, however, that the order or direction of the City Electrician appealed from shall be and remain in full force and effect until set aside by order of the said commission.

5 Any person, firm, or corporation found guilty of an infraction of any of the provisions of this by-law shall be subject to the penalties imposed by by-law No. 1630 of the city of Winnipeg.

Rapid Increase in Electric Furnaces

"Industrial Heating as a Central Station Load" is the latest booklet published by the Society for Electrical Development on selling the idea of doing things electrically. Before publishing this booklet the whole industrial heating field was carefully analyzed by the engineering staff of the society. Every fact, every theory every practical application was looked into, with a view to publishing the very best analysis possible for the benefit of members of the society and the entire electrical industry. New conditions and the war make this book very timely.

Part I., just out, deals with electric furnaces. The book

Table of Types of Electric Furnaces by Countries of the World Operating or Contracted for on Jan. 1, 1917
With Totals for 1916, 1915; 1913 and 1910

	Heroult	Girod	Induction	Stassano	Keller	Chapelet	Nathusius	Snyder	Wile	Rennerfelt	Grönwall-Dixon*	Greene	Special	Greaves-Etchells	Total Jan 1, 1917	Total Jan 1, 1916	Total Jan 1, 1915	Total July 1, 1913	Total March, 1910
Germany and Luxemburg..	19	5	19	2	3		4								52	53	46	34	30
Austria-Hungary .	10	2	3	2						1					18	18	18	10	10
Switzerland	1	2								1					4	4	3	2	2
Italy...	4		2	13	5	5									29	22	22	20	12
France	19	7	2							1					29	21	17	13	23
Great Britain..	34	1	2	4				6		7	14			20	88	46	16	16	7
Belgium. .	2	1													3	3	3	3	3
Russia	3	1	1	2						7	2				16	11	9	4	2
Sweden. ...	3		1							34	2				40	23	18	6	5
Norway			2						1	6					9	6	2	3	
Spain			1								1				2	2	1	1	
Japan	1		1												2	1	1	1	
Mexico			1												1	1	1	4	3
Australia											1				1	1	1		
Chile																1			
Roumania	1														1				
Location not given.			12										9		21	[illegible]	1		
Total outside the United States and Canada. ..	97	19	47	23	8	5	4	6	1	57	20		9	20	316	22[illegible]	170	118	101
United States	79	4	3	1				19	1	13	8	1	7		136	73	41	19	19
Canada.	5							3			1		10		19	8	.		
Total in U. S. and Canada	84	4	3	1				22	1	13	9	1	17		155	81	43		.
Grand Total in World	181	23	50	24	8	5	4	28	2	70	29	1	26	20	471	308	213	[illegible]	[illegible]

*Electric metals in Great Britain

will be a matter [illegible] valuable information to you, even if there isn't a possibility of a furnace in your city to-day.

Part II., to be mailed May 10, will give in compact form for ready reference facts and data as to various uses and applications of commercial electric heating, which will apply more particularly to the smaller cities.

A table showing the number of electric furnaces in the various countries of the world at date January 1, 1917, is given herewith. It will be noted that during the last three years Germany has increased her furnaces from 34 to 52, Austria from 10 to 18. It is noticeable that neither of these countries have made any increase during the last year. Italy has increased from 20 to 29, France from 13 to 29, both of these countries showing substantial increase during 1916. Great Britain has increased from 16 to 88. Russia has increased from 4 to 16, Sweden from 6 to 40, Norway from 3 to 9. The United States shows the greatest increase, namely, 19 to 136. Canada is doing well, having 19 furnaces now in operation, as compared with 3 in 1913.

The Heroult type furnace is the most widely installed, having a total of 181 out of 471. Next comes the Rennerfelt, with 70, and the induction type, with 50.

Since this table was compiled an order has been placed by the Imperial Munitions Board for 10 Heroult type furnaces in Toronto. The Carbon and Alloys Company, Ltd., are also installing a Moffat type furnace.

Montreal Section C. E. A.

A Montreal companies' section of the Canadian Electrical Association has been formed, and has a total membership of 90, of which 75 have just joined. At a meeting, held in the Power Building on April 24, the following officers were elected: Chairman, Mr. James Wilson, Shawinigan Water and Power Company; executive committee, Messrs. J. B. Woodyatt, Southern Canada Power Company; P. T. Davies, Montreal Light, Heat, and Power Company; George McDougall, Athabaska Water and Power Company; L. C. Haskell, Southern Canada Power Company; R. J. Beaumont, Shawinigan Water and Power Company; chairmen of committees: hall, Mr. George McDougall; publicity, Mr. H. M. Williams, Montreal Light, Heat, and Power Company; educational, Mr. H. E. Randall, Shawinigan Water and Power Company; meeting and papers, Mr. J. B. Woodyatt; membership, Mr. V. G. Bartram, Shawinigan Water and Power Co.; secretary, Mr. R. J. Beaumont; treasurer, Mr. L. C. Haskell. The first regular meeting will be held at Y.M.C.A., May 16, when a paper will be read.

Annual Toronto Meeting A. I. E. E.

The annual meeting of the Toronto section of the A.I.E.E. was held in the Engineers' Club on Friday, April 20. Mr. Ernest V. Pannell read a paper entitled, "Rapid Transit Railways—Some Features of Construction and Cost." The re-election of officers and executive for the 1917-18 term resulted as follows: Chairman, W. C. Gordon, transportation engineer, Canadian General Electric Company; secretary, Ernest V. Pannell, electrical engineer, British Aluminium Company; executive committee: E. M. Ashworth, assistant general manager, Toronto Hydro-Electric System; A. H. Hull, assistant engineer, Hydro-Electric Power Commission of Ontario; Wills Maclachlan, inspector, Electrical Employers' Association of Ontario; William Volkmann, engineer, Toronto Power Company; and E. J. T. Brandon, Hydro-Electric Power Commission of Ontario.

Canadian Electrical Association Will Hold Regular Convention in June

At a recent meeting of the Managing Committee of the Canadian Electrical Association it was decided to hold a convention of all the members of the association in Montreal on June 7 and 8. This is the first convention of this kind since the war began, the conventions of 1915 and 1916 being merely a brief gathering of Class "A" members.

This year's convention will be similar to pre-war conventions of this association, except that all entertainment features will be eliminated. The spirit in which the association will meet this year is well expressed in the following motion, which was adopted at the Ottawa meeting of the Managing Committee:

"That this association hold a strictly business two-day convention on June 7 and 8, in Montreal. That no fund or provision be made for the entertainment of delegates, but that arrangements be perfected for full reports from the various technical and commercial committees of the association, these reports to be distributed in advance and discussed at the convention. That the meeting be made as practical and businesslike as possible, with the view not only of stimulating membership, but also being of the greatest assistance possible to those attending."

In connection with the meeting the secretary of the association, Mr. Alan Sullivan, is sending out letters, from his Toronto office in the Excelsior Life Building, to all members, asking them to note carefully the following conditions under which the convention proceedings will be governed:

1. The Managing Committee feels that the time is ripe for a meeting of the above character.

2. Many developments have taken place in the electrical world since we have had an opportunity to discuss these matters.

3. No jollification is contemplated, and we ask your attendance in the interest not only of your own affairs, but also of the industry at large.

4. The National Electric Light Association has given up the idea of its usual type of convention for this year.

5. Under the circumstances the association is not making any special arrangements either for accommodation or transportation. These are matters which each delegate will settle for himself.

6. Place of meeting will be the Ritz-Carlton Hotel, and arrangements will be made that, on the evening of June 7 we may dine together, at a set rate for each person.

7. Please acknowledge this notice, and state whether you will be represented, and by how many individuals.

The Evolution of the Electrical Process of Manufacturing Steel

By Mr. Geo. M. Berry

Part II—Arc Furnaces

The Stassano

The Stassano furnace is of arc type, and consists of a cylindrical outer casing of properly reinforced iron or steel plates, surmounted by a conical roof. The furnace is lined with magnesite brick. It is built of both stationary and rotating design, and when the later, the axis of the furnace about which it rotates during the operation includes an angle of about 7 degrees with the vertical. A three-phase alternating current of 90 volts is delivered to the three electrodes which nearly meet in the centre of the interior of the furnace. The capacity of the different furnaces in operation varies from 200 h.p. to 1,000 h.p. The furnace is used both for reduction of ores and making iron castings or steel direct and for refining of steel either melting cold scrap or taking hot metal. According to the inventor, "the construction of the furnace is the same, whether it is used for ore reducing or steel refining, with only slight alterations, such as for instance when refining steel the use of the top escape for gases may be omitted. The product depends on the charge introduced into the furnace, which is governed by the nature of the work to be done.

The Rennerfelt Furnace

The Rennerfelt furnace is like that of Stassano, in that it is a purely arc furnace, and is not particularly like it in any other respect. The furnace, as at first developed, is essentially a cylinder, having its longitudinal axis horizontal. This has so far been built in two designs, one so that the furnace rolls having the tap-spout in its side, the other so that one end of the cylinder in which the tap-spout is placed is lowered for tapping. The newer type is rectangular externally, circular in hearth, and electrode points may be raised or lowered.

The furnace has three electrodes, and the principle consists in having two of these electrodes in the horizontal, one entering from each side somewhat above the slag—about 15 inches—while the third electrode enters from the top, immediately over a point midway between the other two. The furnace uses a three-phase current, which is changed (by means of a Scott connection) to two-phase, three-wire system.

The middle conductor and the middle electrode carries about 40 per cent. more current than the two outside electrodes, with the result that the arc is subjected to a very phenomenal deflection downward. This is the distinctive feature.

The effect of this is to force the intense heat of the arc down onto the bath, spreading the flame so that its heat can be largely absorbed there, thus greatly saving the roof, and reducing costs and loss of time in making changes. In the larger furnaces more than one of these groups of three electrodes may be placed, the distance between the horizontal electrodes from tip to tip being 18 to 22 inches.

The first furnaces were three-ton capacity or under, but a four-ton has lately been built. The smaller furnaces have one door and the larger ones only two doors. With 50 to 60 cycle current the power factor is said to be 90 to 97.

The Keller Furnace

The original Keller furnace is of resistance type and used for reducing ores to metal. It consists of two vertical iron casings of square cross-section, forming two shafts, communicating with each other at their lower ends by means of a lateral canal. The casings are lined with refractory material. Two different classes of furnaces were used for the early work. In the case of the first furnace employed, the lateral canal was widened out at its centre to form a reservoir for the accumulating melted metal, from which it could be tapped after the slag had been withdrawn, from tap holes, one for each shaft, situated at the lower end of the shaft and above the level of the tap hole of the metal reservoir. In the base of each shaft is a carbon block, and these carbon blocks are electrically connected on the outside of the furnace by copper bars. The carbon electrodes to which the current is distributed pass two thirds of their length into the shaft.

The New Keller Furnace

The new Keller steel furnace, of tilting design, is unlike any other, both in the mechanical handling of its electrodes and with its bottom. In this earlier practice Keller used his electrodes in series, but later places them in parallel.

At each of the four corners of the superstructure are two swinging arms for holding the electrodes. When the furnace is in operation four of these arms are swung in over the furnace so that when they are in position the ends of the four electrodes form a square. The other four swinging arms are for reserve electrodes to facilitate rapid change when a new electrode is needed in the furnace. The electrical connection of the electrodes is made to the bus bars, held well out of the way overhead by the cross-beams of the superstructure.

The bottom is a conducting hearth, made of iron bars of 1 in. to 1¼ in. diameter, placed regularly 1 in. to 1¼ in. apart and fastened to a metallic plate at the bottom. These pins are placed so as to completely cover all of the area of the bottom. All of the spaces between these pins are filled with the magnesia bottom material, rammed in while hot with a special tool for the purpose.

The general operation of this furnace is much the same as the others of this arc resistance type.

The Girod Furnace

The early furnace of this inventor was a purely resistance furnace. The only novelty over the crucible was that it was heated electrically. It consisted of a crucible, with its sides and bottom surrounded by a granular resistance material, and having two horizontal electrodes led in from opposite sides to the resistance material. The resistance to the current in this material was the source of heat. The furnace was mounted on trunions, so that it could be tilted. This furnace was about 200 h.p., with very low voltage. The temperature is reported to be capable of control at as low as 500 degrees C., if desired, but could be raised to well above the melting point of steel (an estimated temperature of 3,500 to 4,000 degrees C.). It was of about 150 kw., and was reported to produce 2,000 Kg., or 4,400 pounds of steel per day.

The new type of Girod furnace is similar to that of the Heroult furnace, except as to electrodes. These may be one, two, or more, and are all of the same polarity, whatever their number, while the other pole is provided in the bottom of the furnace. All of the electrodes at the top are in parallel. The electric current goes from these electrodes into the slag, thence into the steel bath, and thence out by the bottom. This is then a combination of arc and resistance, the slag and steel presenting two resistances in series. The newer furnaces of this type are three-phase. With this there are four electrodes 14 in. diameter. Two of these are each connected to a phase. The other two are connected in parallel with the third phase, while the hearth is connected so as to form the neutral point of the system.

The chief feature of the Girod furnace is the soft iron plugs, water cooled at the outside ends, which project up through the bottom and serve as the bottom electrode

Chapulet Furnace

This is used at Allevard, France, and is closely similar to Girod in current arrangement and in manner of heating.

The Gronwall Furnace

The first Gronwall furnace was rectangular, used two electrodes, and was, in shape and appearance, very closely similar to the Heroult early design, and did not differ from the Herould materially, except that it, like the Girod and some others of this class, had one pole of the current in the bottom of the furnace. The present pattern of this furnace is like the later designs of both the Girod and Heroult, also of circular plan, but the electrode application is different. The furnace now has four electrodes, which utilize a two-phase system and are connected two each in parallel to a phase. In the bottom is a conducting block (in the first furnace, carbon) of large area, which is covered with a thick layer of the furnace bottom refractory material. This block forms a neutral or ground. In conjunction with this arrangement (covered by patents controlled by John A. Crowley Company) is employed an arrangement whereby it is possible to operate the furnace at a range of different voltages, either across the electrodes or through the bath to the neutral, which is embedded under the lining and does not come in contact with the bath. These furnaces are all reported as producing high-grade steel and vary in capacity from 1¼ tons to 10 tons. The one furnace in this country—Kayser, Elleson & Co., Sheffield, at Detroit—is of 5-ton capacity.

The Nathusius Furnace

The Nathusius furnace, which has been in commercial use in Germany—at Friedenshutte, in Silicia—is of arc resistance type; and, like the Keller, Girod, and Gronwall, has the current pass through electrodes in the top of the furnace, through the slag and metal, to conduction points in the bottom. With this furnace, which is circular, there are three electrodes, in delta form, projecting through the roof, which comes down nearly to the slag line, and three corresponding electrodes coming up from below into the bottom. These do not come all of the way through the bottom, but have their upper ends covered over with several inches of the bottom material. The current is three-phase, and with this arrangement of electrodes there are three paths of currents—(1) the arcs through the slag from the upper electrodes to the neutral point in the bath; (2) from the bottom electrodes to the bath; (3) from the upper electrodes directly to the bottom electrodes.

An arrangement is provided by utilizing an additional transformer, whereby the voltage of the current to the bottom electrodes may be increased at will when it is desired to give increased heat directly to the bottom. There are four of these furnaces in operation, of which the first, in 1909, was 3-ton capacity, and the second, installed soon after, was 5½-ton capacity.

The Wile Furnace

The Wile furnace is a three-electrode, three-phase furnace, having one electrode connected to each phase. Two of these electrodes are introduced through the top, while the third is introduced through the bottom. The bottom electrode does not project clear through the bottom so as to come in contact with the metal of the bath, but is covered over with a layer of the bottom material. This is magnesite and tar. The advantages claimed for this furnace are that in refining liquid charge a quiet circulation is given to the metal, and in melting cold charge the bottom electrode produces at the beginning a pool of liquid metal in the bottom, thus reducing to a minimum the breaks in the arc and improving the load factor.

The Snyder Furnace

The Snyder furnace is circular in plan, single phase, using a single electrode in the top, which is introduced through the centre of the roof. The other pole is a metallic electrode, which extends clear up through the refractory bottom material into the bath, where the upper end is, of course, continually melted off. This electrode is water-cooled at its bottom end.

The furnace is built in different sizes, principally 3-ton and 6-ton, is designed to run at 220 volts, and the 3-ton furnace takes about 850 kw. It is operated with either acid or basic lining. The furnace recently installed at the Halcomb Steel Company's plant is basic lined and of 3-ton capacity. This installation is not yet past the experimental stage. We have already made a number of radical changes, both in electrical control and in protection of the refractories, and it is probable that still other important changes will be made. While no attempt has so far been made to try the furnace out through the full range of compositions which constitute the product of this company, yet some very good work has been done with it in making certain grades which have so far been attempted in it. The power factor is good.

The Heroult Furnace

The Heroult furnace is described in the Canadian Commission's report as follows:

"The furnace is of the tilting pattern. It consists of an iron casing, lined with dolomite brick H H, and magnesite brick around the openings. The hearth is formed of crushed dolomite K, rammed on top of the dolomite brick lining of the bottom of the iron casing. Two electrodes EE pass through the roof of the furnace, which, in the Kortforts furnace, was water-jacketed for a short distance above and below their passage through the iron casting of the roof. The current passes from one electrode through the narrow air gap to the molten metal, along it, through the slag and second air gap, to the other electrode. An alternating current of 4,000 amperes and 110 volts was delivered to the electrodes. The intensity of the current passing through the bath is regulated by adjusting the width of the air gap between the electrodes and the slag line. This adjustment is effected either by hand or automatically by a special constructed regulator."

In the first five years following the beginning of operation of the Heroult process at the Halcomb Steel Company, installations were made at McKeesport, Pa., by the Firth-Sterling Company, at Worcester, Mass., by the American Steel and Wire Company, and at South Chicago by the Illinois Steel Company. There were, perhaps, also some American installations in other localities for steel castings, etc. Those installations at Worcester and South Chicago are 15-ton capacity, and were, until recently, the largest built. They are now exceeded in size by two 25-ton furnaces of the same general type in France and two in Germany, one of 28 tons at Bruckhausen and the other of 30 tons at Dortmund.

The Worcester furnace was designed for using molten basis open hearth metal for making steel for wire, while that at South Chicago utilizes molten metal from the acid Bessemer in producing principally steel for rails, said to be greatly superior to those of open-hearth steel.

These two 15-ton furnaces and also the later installations in various places use a three-phase electric current, and are of slightly different design from the single-phase current furnace. The essential difference is that in place of two vertical electrodes there are three, so placed that their ends form an equilateral triangle, with the apex towards the back of the furnace. Each electrode is connected to a phase of the three-phase circuit. The shape of the furnace in its plan view is, in general, circular.

As pointed out in the Bureau of Mines Bulletin of February, 1914, "Electric Furnaces for Making Iron and Steel," from which I quote:

"The Heroult electric steel furnace heads the list of electric furnaces in use in the iron and steel industry, with 31 furnaces already built and 20 others in course of construction. The wide use of the Heroult furnace is due chiefly to its efficiency, simplicity of construction, and adaptability to many different uses. Also it was the pioneer electric steel furnace."

The author counts it no small honor to have been intimately associated with the development of this process by the Halcomb Steel Company at Syracuse, N.Y., from its inception to the present. Concerning the state of development of this process, it must be said that there is a vast difference between the academic statement in 1904 of the process and the achievement of the present in every-day practice.

The installation and initial operation of the process at Syracuse was under the personal supervision of its inventor, Dr. P. T. L. Heroult, and yet the practice and results of those days of early 1906 are in vast contrast to the results being obtained to-day. The character and life of refractories, the method of handling the doors, the water-cooling devices, the shape of the electrodes, the character of the slag, and the definiteness of control, all represent distinct advance. These and other advances, without question, could not have been made in so short a time without competent and skilled steelmakers, who not only were in full sympathy with the new process, but who were also steel men whose families for generations before were connected with the fine steel industry.

The first installation operating the Heroult process at the plant of the Halcomb Steel Company begins with the raw materials in the form of pig iron, scrap, and the necessary fluxes, which utilizes a 25-ton Regenerative Wellman tilting basic open-hearth furnace, in which the dephosphorizing is done and the steel refined to a very pure grade of open-hearth steel. This is taken molten, in weighed amount, to the electric furnace, where the sulphur is removed and the metal freed entirely from oxides and gases; thus a very pure iron may be obtained. The metal while in the furnace is examined, both physically and chemically. To this steel of known composition and free from tendency to chemical change additions are quantitatively made of carbon and the metals which it is desired to have in the finished steel. This procedure gives with the greatest accuracy the composition desired in the finished heat. The time required for the metal in the furnace is approximately 1½ hours, but this is dependent on the number, amount, and character of the additions. When the heat is finished, it is tapped and cast into ingots.

(To be continued)

The Manufacture of Munitions in Canada, and the Permanent Assets to Canadian Industry Resulting Therefrom

By Col. David Carnegie*

I SHOULD like to refer first to Canada's capacity to produce munitions; second, to the permanent assets to Canadian industry arising out of munitions work; and, third, to the responsibility of engineers in developing these assets.

Canada's Capacity to Produce Munitions

In September, 1914, when General Sir Sam Hughes undertook the first order for shrapnel shells Canada's capacity to produce shells amounted to 340 18-Pr. shrapnel shells per week. These were made at the Dominion Arsenal, Quebec. The capacity of Canadian factories to-day approximates 400,000 18-Pr. shrapnel complete rounds per week, including cartridge cases, primers, fuses, and propellants. In addition to this amazing output there is a weekly capacity in Canada for nearly 400,000 high explosive shells, ranging in sizes from 18-Prs. to 9.2 in., making an approximate total weekly output of 800,000 shells. This large output, along with other supplies made independently, requires about 25,000 tons of steel per week, 2,500 tons of brass, 750 tons of copper, 250 tons of zinc, 1,500 tons of lead, 200 tons of antimony, 150 tons of resin, several tons of ferro-molybdenum, and about 500 tons of cordite, 500 tons of trinitrotoluol, and 300 tons of nitrocellulose powder.

Over 300,000 boxes are required for these shipments per week, and about three and one-quarter million lineal feet of board are used in making these boxes.

The weekly value of these products can only be understood by people who have learned to think in millions. The total value of orders for munitions placed in Canada approaches eight hundred million dollars and the value of the munitions shipped is close upon five hundred million dollars.

The Amount and Value of the Plant Employed in Producing Munitions

Looking again at the magnitude of munitions work in Canada to-day, we see 650 factories engaged in 144 towns scattered throughout every province of the Dominion except Prince Edward Island. Cities as far apart as St. John, Newfoundland, and Victoria, B.C. (a distance approximating 4,500 miles) are contributing to the output. Manufacturers from almost every industry in Canada have turned their attention to the production of munitions, and it is gratifying to record that few of them have failed in producing the standard of work required.

Some idea of the amount of plant and machinery installed can be obtained when it is remembered that apart from the large increase in the number of steel-making furnaces which have been installed since the war commenced, there are 26 contractors making shell forgings, with total forging press capacity of 61,000 tons. This tonnage is represented by 162 forging presses, the largest having a pressure of 1,500 tons and the smallest 200 tons. In order to feed these presses with steel for forgings 200 furnaces have been built. The presses are driven by 120 sets of pumps, having a total electric motor capacity of 21,000 h.p. The approximate value of shell forging plant machinery installed is estimated at $5,000,000.

Coming to the plants for the machining and assembling of shells and the manufacture of component parts, there have been installed over 18,000 machines and 90,000 h.p. to drive them, the estimated cost approximating $35,000,000.

Gauge Production

One can hardly mention this subject without being reminded of the almost insuperable difficulties which were presented in the early days of the war in obtaining gauges for munitions. We can never thank the United States manufacturers sufficiently for what they did in coming to our aid at that time. The special skill in making gauges to the limits of accuracy required could not then be found in Canada. To-day there are at least 20 factories producing gauges in Canada; and while we are not independent of help from the States, some idea of the magnitude of the work can be understood from the monthly bill, which amounts to over $150,000 for new gauges.

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* Extracted from recent addresses before the Ottawa Branch C. S. C. E. and the Engineers' Club, Toronto.

During the month of March about 10,000 new gauges and checks were inspected. The usual accuracy called for on a gauge is .0002, or 2/10 thousands of an inch; and for a check, 1/10 thousand.

An army of over 5,000 examiners are engaged upon the inspection, under the direction of Colonel Edwards and his staff of officers.

Production of Copper, Zinc, and Other Metals

In addition to the production of steel, the manufacture of forgings, the machining and assembling of shells, and the manufacture of cartridges, cases, fuses, primers, and other components, the mining and metallurgy of metals for munitions manufacture have played an important part in Canada. Copper and zinc are now refined in the Dominion instead of being sent in the form of concentrates of zinc and copper matt to the United States for refining there. Copper products, such as copper bands, are now being manufactured in Canada on a commercial basis. Brass cartridge case material, so difficult to obtain in the early months of the war, is now being made successfully in Canada. Other materials, such as lead, antimony, arsenic, tungsten, molybdenum, and aluminum, have been produced for munitions.

Production of Explosives

Side by side with these developments there has grown a capacity for explosives even greater in proportion than that of metals. In order to complete what we call the fixed 18-Pr. round of ammunition, it is necessary to make cordite or nitrocellulose powder, and while experimental amounts of cordite had been produced before the war, Canada's capacity to-day approaches 1,000,000 pounds per week of both cordite and nitrocellulose powder.

One of the principal explosives used for bursting shells, known as trinitrotoluol, has been made successfully in Canada for over two years from the by-products of the coke ovens. To-day the production approaches 1,000,000 pounds per week.

National Factories

Among the many contributing features of successful production to-day started by Mr. Flavelle soon after he became chairman of the Imperial Munitions Board was the creation of great national factories in Canada. In addition to stimulating and developing companies in Canada he set in operation several national factories for the loading of fuses, the manufacture of gun cotton, acids, trinitrotoluol, aceton, cordite, nitrocellulose powder, aeroplanes, and electric steel.

These factories are operated by separate companies, the entire stock of each company being held by the Imperial Munitions Board.

In this connection it is interesting to know that aeroplanes are being made in Canada at about the rate of one per day, and when the new factories are completed five per day are expected.

Permanent Assets to Canadian Industry

Hurrying from these few facts about the output of munitions in Canada, without even touching upon what would be a fascinating subject to you as engineers (I mean the scientific processes involved), and also leaving entirely out of consideration the gruesome purpose in actual warfare for which the munitions are required, I pass on to consider the value of this unholy business as a permanent asset to Canadian industry. I should like to divide the total value of the permanent assets, as I view them, into two parts—the first resulting from the standardization of products, the second from the standardization of skill.

1. The Standardization of Product

No component part of munitions, however insignificant, has been made or accepted on the old principle of "good enough." Every part has been supplied to drawing and specification, with rigid examination, analysis, and test, before acceptance.

I think I am safe in saying that there is no industry in Canada which has been occupied in the manufacture of munitions but has passed through a process of refinement, which will leave it in a better condition when it returns to domestic pursuits after the war. If you review the great industries of Canada it will be difficult to find one which has not been actively contributing to the output of munitions.

Industries such as the iron and steel, the metals and metal products, refractory materials and fuels, lumber and timber, leather, textiles, paper, chemicals, and other minor industries, have called into being processes and plant which could be adapted for munitions, and have also added new processes, new equipment, and new skill where these were required.

In addition to the employment and adaptation of existing industries for munitions manufacture, entirely new industries have been brought into activity. The manufacture of munitions has given an abiding impetus to the mining and subsequent operations in the production of coal, iron, copper, nickel, zinc, molybdenum, antimony, aluminum, and other metals.

The chemical industries have been accelerated by utilizing the waste products of the coke ovens for the manufacture of high explosives. These waste products after the war will be turned, by ingenuity and skill, into valuable domestic products.

The electro-chemical industries, such as the refining of copper, zinc, and lead, have been initiated, and will remain as a commercial asset. The electro-thermic processes for the production of ferro alloys, such as ferro-silicon, ferro-manganese, ferro-molybdenum, aluminum, magnesium, and other metals, have produced standardized products.

It has been a costly, and sometimes bitter, training, but it has been done ungrudgingly and with great patience; and, as a result, the standard of Canadian products to-day is greater than ever before.

2. Standardization of Skill

The widespread knowledge of new processes, involving the scientific study of metals, the flow of materials, and their physical, chemical, and metallurgical values, has been such that one can hardly imagine it would have been possible for the universities and technical schools of Canada to have provided such instruction in the course of many years which has been crowded into as many months. Every workshop has been a school of training in standardizing its skill. Every factory in which steel is made and forged is now partly or fully equipped with the means for measuring temperatures and intelligently discovering the value of the materials with which they are working. In every workshop in the different provinces of Canada where shrapnel shells are made the scientific treatment of steel is known. There is hardly a town of any importance in which the use of precision instruments and gauges for measuring shells and their component parts does not exist.

It is difficult to assess the value of this skill to Canadian industry, in which over 250,000 workers have become skilled in the art of such processes and the manipulation of such tools and gauges. It is more surprising still to know that nearly 12,000 women have become skilled in this work. Never in the history of the world has there been such an incentive to acquire such skill for a purpose the like of which our civilization should be ashamed, but which is nevertheless an asset which will be of great value in the peaceful commercial industries for the expansion of Canada.

The Responsibility of the Engineer in Developing These Permanent Assets

Gentlemen, ours is an honorable profession, one crowded with vistas of research and delights, the like of which even the angels might envy. This war has awakened the slumbering forces in the human mind and brought into activity engineering genius unequalled in quality hitherto. Your great waterfalls have been transformed by your skill into the most resourceful agency of power, without which we would have hopelessly failed in reaching the output of munitions named. Your skill has mined, smelted, and fabricated the many metals which have proved to be of such value for munitions. The great engineering plants which have been brought into being by your skill are monuments of industry which must not be allowed to rust when this war is over. There is a great responsibility resting on you as engineers and leaders of industrial thought and action. It is greater to-day than ever before in the history of Canada. The opportunity given to you of taking and intelligently using and directing those assets of which I have spoken is of vital importance to Canada's successful industrial development. There is no need to wait for royal commissions. Power and authority are vested in yourselves; nothing will be too great for you if you see your opportunity, and if you have faith in the engineering talent of Canada. The man who was afraid and went and hid his talent in the earth brought forth the most scathing reproof ever uttered.

If I were to venture to suggest a program for your immediate consideration, I would advise you to classify and value the engineering skill of your societies, with the object of forming in Canada from their membership small committees of scientific, technical, and commercial men, who would be responsible for obtaining from the accumulated reports of commissions and numerous supplies of information stored in government departments and elsewhere relating to the best standardized processes, equipments, and plants for the development of the industry they represented. Each committee would, therefore, become the recognized source of classified information, to whom manufacturers could with confidence refer for any help and advice required.

If your inventory of classified ability were broad enough to include the fuller issues in developing the standard of products, skill and utilitarianism, I should utilize every willing member of your profession, making committees, say, of members not exceeding three, for the consideration and report of the following subjects:

1. Industrial, technical, and commercial education for our boys and girls before and after leaving the day school.
2. The classification and valuation of labor.
3. The remuneration and hours of labor.
4. The direction and character of employment in classified industries.
5. The provision of methods for the prevention of unwholesome competition between manufacturers.
6. The provision of definite standards for checking the formation of doubtful companies.

Then, with a central authority, you could co-relate the efforts and information of your scientific and industrial committees for a broader policy of universal trade.

Canada's Big Opportunities

By the consideration of some such programs those valuable assets which are now the heritage of the Canadian people will make this country prosperous. Canada has its opportunity to set the pace in the world's industry. Its finances were never better. Last year its exports exceeded its imports by $340,000,000. Its natural resources cry out to you for their development. It is a country in which there is a heritage of wealth far exceeding that with which our youthful imaginations surrounded "Treasure Island." Your efforts in embracing those opportunities will be strengthened by a more complete education of the industrial workers, and by a heartier co-operation with the employees.

A nation, said President Wilson, is as great, and only as great, as its rank and file. Will you gentlemen see that the rank and file who make this nation follow those lofty standards of education and sacrifice which make life great? It would be terrible if we missed the way after such a struggle.

There is a great industrial war before us, for which we are unprepared. This might have been avoided if a harmonious united federation of the world's industrial councils were possible. No doubt the distant future will produce the genius for such an undertaking. Meanwhile we cannot escape the responsibility before us.

Since the war started the eyes of the world have been turned towards Germany. The history of that country, the characteristics of its people, and the success with which for years prior to the war they flooded the markets of the world with products, the prices of which became almost a menace to all other manufacturing countries, have inspired a determination by the people of the competing countries to put their industrial house in order to meet all reasonable competition. German militarism will be crushed before the Allies sheath their swords, but to crush the industrial spirit in the Germans, which has made their country prosperous, would be to destroy the very spirit we now seek to stimulate in ourselves. The industrial prosperity and triumph which put Germany before the war in the front rank of the world's commerce can never be crushed—indeed, it would be folly to attempt to crush it. The world demands the best from every nationality, and amongst the many lessons this war has taught the nations of the world is the very old and common one—that out of persistent and well-balanced, indomitable courage comes the ability which brings success.

An Industrial War Is Coming

Peace is coming; when it is declared, the struggle for industrial supremacy will intensify in the German people. The very qualities of sacrifice, courage, endurance, enterprise, and genius which this war has developed throughout Canada and the British Empire, among our Allies and our foes will not by any chance lose their value on the Germans; but, on the contrary, if, as we believe, German military arrogance will be swept away, her industrial classes will, by reason of the opposition to her commerce and trade, struggle to maintain a higher efficiency within her borders. Before many years the world's markets will be flooded again with products at much lower prices than it is even now possible to conceive, with the result that hate and prejudice to German goods will die away before a temptation so strong that the purchasing value of the wage-earning classes will find it necessary to buy in the lowest markets, although the products be from Germany.

One can imagine, judging from the procedure in the past, that since the war began the accumulation of products in Germany, the outlets for which have been closed, will be dumped on the world's markets immediately peace is declared, with a new propaganda which these closed years have inspired. The very thrift which privation and sacrifice have demanded from the people will encourage even more than ever the utilization of every form of waste product.

The directors of the Brompton Pulp and Paper Company, East Angus, P.Q., announce the abandonment, for the time being, of the proposed extensions, including the development of a further water power on the St. Francis River, three miles below the pulp and paper plant at East Angus. The directors state that their action is due to the new basis of taxation upon commercial corporations outlined in the budget. It had been announced that a contract for the water turbines and governors was given to the Canadian Allis-Chalmers, Ltd., and one for the generators, exciters, transformers, etc., to the Canadian General Electric Company.

Electric Railways

The Construction and Cost of Rapid Transit Systems—Comparative Figures on Elevated, Subway and Tubes

By E. V. Pannell, Assoc. Mem. I.E.E.*

With the growth of population there is a stage in the development of every city where the daily travelling personnel can no longer be handled by the street railways. It is quite impossible to state any figure for population at which an urban rapid transit system must necessarily relieve the surface railways. For instance, the Boston Rapid Transit was operating its elevated lines and part of the subway when the inhabitants numbered little more than half a million, whilst in London, England, the population reached six millions before a unified electric rapid transit system was inaugurated. The width and disposition of the down-town streets, the layout and general efficiency of the street railway system, the size and speed of the cars are all factors which, if favorable, will tend to defer the construction of rapid transit lines. Nevertheless, in matters of this kind it is necessary to plan many years into the future, and preparations should be made for rapid transportation methods many years before the need of them is acutely felt. In view of the many millions of dollars now being expended on rapid transit projects, it was thought interesting to summarize the principal costs of construction and equipment of rapid transit lines of various types. It is, of course, hardly necessary to mention that these costs are only intended as a rough approximation, such items as subway excavation, underpinning, etc., being different in every locality. The costs are mainly figured upon contracts placed during the last two years, but do not, of course, allow for the abnormal conditions prevailing at the present moment, particularly in reference to steel and labor.

The Elevated

There are three systems of construction for rapid transit railways in cities, and it will be interesting to compare these in detail. They are: (1) Elevated structures, (2) subways, and (3) tubes. The elevated railway, although less popular than the other types, provides the greatest return per dollar invested, and is, therefore, worth very careful consideration in every locality. The earliest elevated roads in Manhattan and Chicago were objectionable from being erected in narrow streets and with an open floor. The open floor elevated road, in which it is possible to see the under-side of the cars from the street beneath, gives rise to a great deal of noise and discomfort, due to hot brake shoe particles, water, etc., dropping into the street. It has since been demonstrated—notably in Philadelphia—that a concrete floor elevated road, with ballasted tracks, is perfectly unobjectionable, except in narrow and busy streets, and the noise produced is less than that of the street car below. In European cities, too, every opportunity has been taken to render the elevated railway as sightly as possible. The ground beneath is turned into a parkway and equipped with benches, whilst the floor of the road, being of concrete and steel, affords protection against rain to those walking beneath.

The elevated railroads in universal operation at the present are of steel construction, with or without a concrete floor. A viaduct built entirely of reinforced concrete, would offer great advantages from the aesthetic viewpoint, and would reduce the noise to a minimum. The only objections would be the interference of the solid structure with light in the street below, and the extra cost.

The objections raised by property-owners along the line of route are very much less loudly voiced than was the case a few years ago. Property of the commercial as opposed to the purely residential type invariably has its value increased by the presence of the railway, and this is still more true of those contiguous streets which branch off the line of route. In comparing various systems of rapid transit it must be remembered that damage claims will have to be met in respect of any kind of construction, and the elevated railway is not much worse off in this respect than a subway. In general, however, efforts will be made to route the railway through the warehouse and factory belts along streets which have not been built up, over secondary thoroughfares which parallel the main streets a block or two away, and over and beside canals and river valleys.

The Subway

The subway next demands consideration, and in comparing it with the elevated it should be remembered that each has exactly the same capacity, track for track. We shall find that the subway costs a good deal more, but in respect of handling traffic it is just as good, and no better, than the elevated road operating the same care with the same headway and schedules. The extra cost of subway construction is, therefore, only justified where it has to be used. For example, in Lower Manhattan or Market Street, Philadelphia, the conditions do not permit of elevated structures and subways in locations such as these are inevitable.

Subways as at present being constructed in New York are of steel beam construction, with concrete floor and retain-walls. The excavation is through clay and sand, with outcrops of rocks, according to the district. The chief difficulty met with is in excavating through quicksand, which, owing to the great weight of the surrounding buildings, persists in pouring up into the subway, and necessitates the retaining walls being carried to a considerable depth below the floor of the tunnel. Underpinning of building foundations is another heavy item in the cost of construction. Subways are excavated by the cut and cover method, but civic ordinances usually require the street to be timbered and made safe for the ordinary traffic to proceed during excavation. This means that hand labor only can be used, and mule trains will be necessary for bringing the muck away from the heading. Appropriation of cellars and the relocation of sewers, telephone and power cables is a necessary preliminary work which must be completed before construction proper is begun.

Examples of typical steel beam subways are Buenos Ayres and Hamburg. The former is part of the new rapid transit development of Buenos Ayres, and runs through the heart of the city, from Plaza Mayo to Plaza. Originally a distance of 2½ miles, the construction is now under way on a farther 2½ mile extension to Caballito, where the subway cars come up to the surface and continue the journey along the highway to the more remote suburbs. The line now in operation involved the excavation of 527,000 cubic yards in alluvia clay or "tosca," and the use of 98,000 cubic yards of brick masonry and 13,000 tons of steel. Brick masonry is used practically to the exclusion of concrete, probably because all the cement used has to be imported, whilst the brick is a local product. The cost of construction on this line amounted to $2,680,000 per mile of double track.

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*Paper to Toronto Section, A.I.E.E.

The Hamburg subway, opened a few years ago, is part of a suburban system, of which 3.41 miles is elevated, 10 miles on the surface on private right of way and 4.15 miles underground. The construction is steel beam, with steel bents in the centre of the tunnel, and concrete retaining walls. Construction costs figured out at $1,000,000 per mile of double track, and it is interesting to compare this extremely low cost with the figures prevailing in America of $2,250,000 to $3,000,000 per mile of double track.

Reinforced concrete for subway construction has been employed with success, notably in the Boston Boylston Street subway and in New York for the Hudson and Manhattan Railway. There is little difference in the cost between steel and reinforced concrete, but deliveries on reinforcing steel are frequently much more prompt than on structural shapes.

The Deep-Level Tube

The third type of construction is the deep-level tube, which is preferable in some locations to the shallow subway. In London, England, where this line has been the farthest developed, the necessity of crossing under the River Thames, as well as the existing underground railways and sewers, was the main factor influencing the adoption of tubes. Added to this, the presence of the blue clay belt from 40 to 200 feet below the street surface rendered it possible to mine by the use of a shield without blasting or any interference with the surface except at the shafts. The clay contains little rock or water-bearing strata; other locations are not so fortunate as London in this respect, however, and it is doubtful whether tubes could be driven through a subsoil like that of Toronto. In New York the deep-level tube is economically impracticable except for river crossings on account of the rock and quicksand which would be encountered.

The depth at which the London tubes are driven—60 to 200 feet below the street, is such as to cause no interference with foundations; and, where necessary, the railway cuts across a block instead of following the alignment of the street above. The method of shield construction forms a constant support to the soil above, and little or no timbering is used. The shield consists of a steel cylinder about six feet long and the same diameter as the outside of the tunnel segments. The front of the shield forms a cutting edge, and the back is provided with seven or eight hydraulic rams around the circumference. These rams obtain their purchase on the last tunnel segments bolted into place, and drive the shield forward at the rate of about ten feet per day when working in clay. In the cover afforded by the shield the heading is driven and earth excavated by hand or by a compressed air excavator. Behind the shield, as the work progresses, the muck is run out along a tram line, and the cast iron tunnel segments are bolted into place. Afterwards the space outside the segments is filled with cement grout, pumped through holes in the casting, thus protecting the segments from rust and decay by the elimination of air spaces.

The foregoing has briefly summarized the methods adopted in building railways of the three types, and, as will be seen in the figures 1, 2, and 3, an approximate estimate has been made of the cost in each case. These costs assume one mile of double-track line, with tracks and third rail laid, stations fitted all ready to operate. An item which does not appear is the real estate occupied by station buildings in the case of underground railways. Generally, however, this is offset by the leasing of the upper floors of the building, as most rapid transit stations form only the basement of the structure. Two stations per mile have been estimated upon, and, as will be seen from Table I., this average is very closely adhered to by most modern transit systems in cities. From the operating viewpoint, of course, the fewer stations the better, but it must be rememberd that the rapid transit systems are always in competition with the street cars for the profitable short distance traffic, and every means has to be adopted to encourage it by providing that the passenger does not have to walk more than 440 yards to the nearest station. A further development is seen in the use of very long trains and station platforms, the latter having a staircase to the street at each end, thus reducing the apparent distance between stations to the minimum

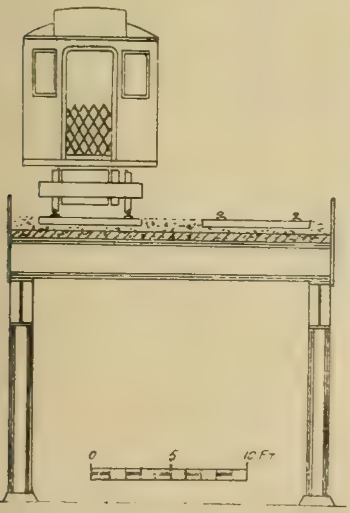


Fig 1—Elevated Railway Construction Cost Per Mile of Double Track—Structural steel, $240,000; concrete footings, $10,000; concrete floor, $25,000; track, roadbed and third rail, $100,000; stations, $50,000; repairs to roadway, $25,000; property damage, 100,000; engineering and interest, 15 per cent., $82,500; total cost, one mile of double track, $632,500

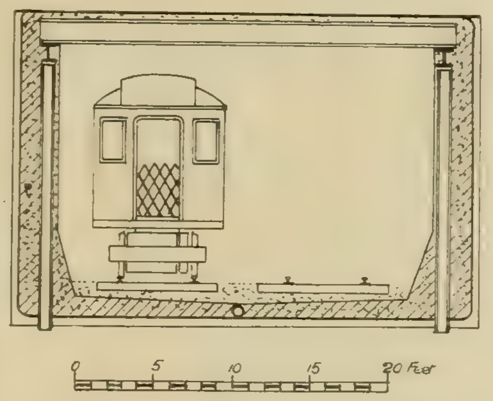


Fig. 2—Subway Construction Cost Per Mile of Double Track—Excavation, $1,100,000; concrete, $375,000; brickwork, $15,000; structural steel, $240,000; waterproofing, $20,000; track, roadbed and third rail, $100,000; stations (2), $50,000; re-locating sewers, etc., $50,000; underpinning, $125,000; repairs to roadway, $100,000; engineering and interest, 15 per cent., $325,000; total cost, one mile of double track, $2,500,000

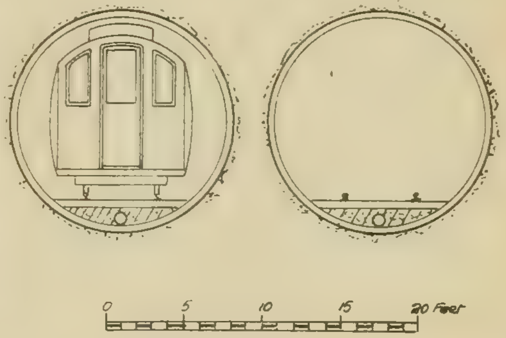


Fig. 3—Tube Railway Construction Cost Per Mile of Double Track—Sinking shafts, excavating with shield, placing tunnel segments, grouting and finishing, $2,000,000; track, roadbed and third rail, $100,000; stations, including elevators and fans, $100,000; repairs to roadway, $20,000; engineering and interest, 15 per cent., $330,000; total cost one mile double track, $2,550,000

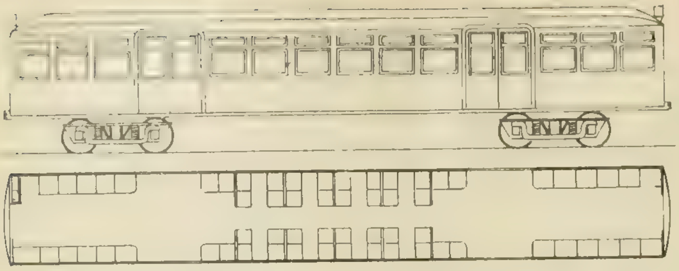


Fig. 4—Details of Motor Cars and Equipment, Elevated and Subway Lines Length of car, 60 ft., width of car, 8 ft. 6 in.; weight of body, 45,000 lbs.; weight of trucks, 26,000 lbs.; weight of equipment, 14,000 lbs.; total weight, 85,000 lbs.; capacity, seated, 64; total capacity, 180; weight loaded, 111,000 lbs.; motors per car, 2 x 120 kw.; rated kw. per ton, 4.3; cars per train, 5; cost per car, $16,000; cost per train, $80,000, cost per passenger, $89

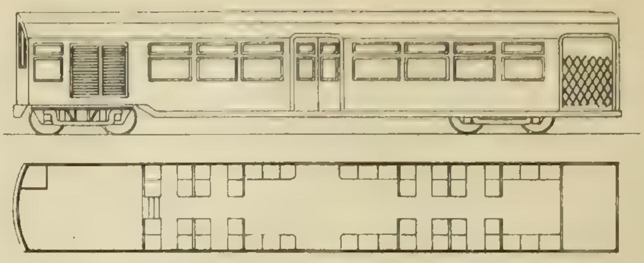


Fig. 5—Details of Motor Cars and Equipment Tube Lines—Length of car, motor, 55 ft., trailer, 55 ft.; width of car, 8 ft. 2 in. and 8 ft. 2 in.; weight of body, 32,000 lbs. and 32,000 lbs.; weight of trucks, 25,000 lbs. and 12,000 lbs.; weight of equipment, 18,000 lbs.; total weight, 75,000 lbs. and 44,000 lbs.; capacity seated, 50 and 56; total capacity, 120 and 135; weight loaded, 92,000 lbs. and 63,000 lbs.; motors per car, two 200 kw.; rated kw. per ton, 4.3; cars per train, 2 and 3; cost per car, $14,000 and $8,500; cost per train, $53,500; cost per passenger, $83.00.

Table I.—Average Length of Run on City Rapid Transit Systems

Railway.	Stops per mile.	Average run, feet.
Buenos Ayres Subway	3.10	1,690
Northwestern Railway, London	1.20	4,400
District Railway, London	1.50	3,500
Inner Circle, London	2.10	2,510
Central London, London	2.10	2,510
South London Elevated	1.20	4,400
Interboro Subway, New York	2.40	2,200
Berlin Elevated	2.00	2,640
Hamburg Elevated	1.90	2,780
Average	1.95	2,700

Summarizing the costs, the investment per mile of double track for construction alone is:

Elevated railway	$ 632,500
Subway	2,500,000
Tube	2,550,000

The above figures are purely construction costs—that is, [illegible] are quite independent of the traffic. The railway will cost just as much to build, whether one or one thousand trains run over the mile of double track in a day. We have [illegible] to add to the above amounts the cost of the equipment of the road that is the cars, feeders, substations, shops, and other items which are all dependent on the number of passengers carried.

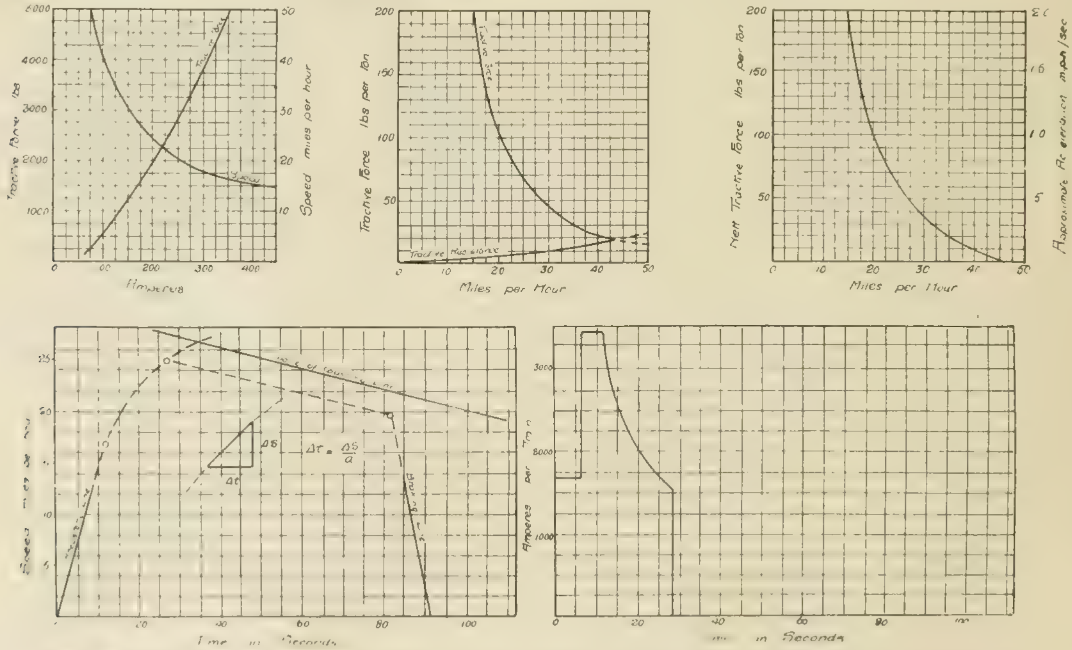


Fig. 6—Method of Plotting Speed-Time Curves—Motors geared 61:22 with 36 in. wheels; train [illegible] 28 [illegible] motor, schedule speed 16 m.p.h. with half mile runs; initial acceleration 1.5 m.p.h.; [illegible] 2.0 [illegible]

Cost of Equipment

The most important feature of the equipment is, of course the cars. In order to obtain the full use of the railway as built it should be operated by multiple unit trains capable of schedule speeds at least double that attained by the surface cars, and the operation of street cars on the rapid transit structure is unsatisfactory except where special tracks and interchange facilities are provided, as is done in Boston and Philadelphia. Present practice is to employ trains of three to ten steel motor cars, each being equipped with two motors rated at around 120 kw., 600 volts, and multiple unit control. Such a train will always have a motor capacity in proportion to its weight, so that schedule speed can be maintained with ten cars just as easily as with a single unit. Trailers are being abandoned in rapid transit service, with the exception of tube lines. Here the conditions are somewhat peculiar. As was noted from the drawings, the diameter inside the tube tunnel is some twelve feet, which is too small to permit of operating the standard type of rapid transit vehicle. It is, therefore, necessary to sling the car body low down between the wheels except at the first and last trucks of the train. Here the floor is raised forming a driving compartment, and these are the only trucks which allow of motors being suspended on the axles.

Details of Cars

The cars illustrated in this study for elevated and subway operation are typical of the more recent rapid transit practice without being quite as large as those now employed by the Boston Rapid Transit and the New York Municipal Railways. Cars 70 feet long and 10 feet wide require so much extra clearance, especially at curves, that a much more expensive subway is necessary to accommodate them. The car illustrated (Fig. 4), which is of a more normal type, is 60 feet long and 8½ feet wide, seating 64 passengers at the rush hour and carrying 180 in all. The weight of the car fully equipped, but empty, is 80,000 pounds; loaded with 180 passengers it weighs 105,200 pounds. Its equipment consists of two 600-volt motors rated at 120 kw. each, fully ventilated and multiple unit control, and the standard train is of five cars, capable of carrying a total of 900 passengers during the rush hours. Such a train as already mentioned can operate over elevated or subway tracks indiscriminately.

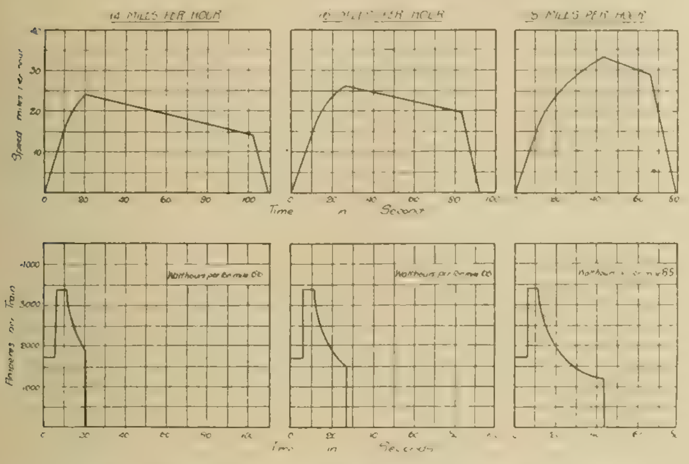
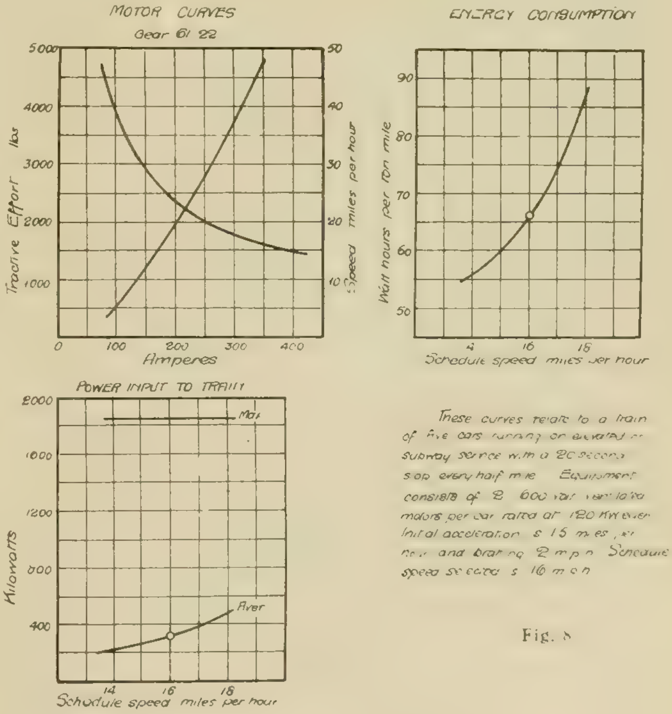


Fig 7 These curves cover the operation of a train over a distance of 2640 feet between stops, at schedule speeds of 14, 16, and 18 miles per hour. Duration of stop is 20 seconds; initial acceleration, 1.5 m.p.h. and braking, 2.0 m.p.h. Equipment consists of five cars, each weighing 111,000 lbs. loaded and equipped with two 120 kw., 600 volt ventilated motors.

Turning to the tube car, it will be seen that the capacity and weight are both lower than the above. Moreover, as mentioned before, space considerations permit of only the leading and trailing trucks of the five-car train being used to carry motors. In order to maintain the same schedule speeds as the subway train, the rated kilowatts per ton must correspond with the figure 4.3, and to obtain this the four motors must each be of 200 kw. rated capacity. This involves certain disadvantages. For one thing, the weight of the train is largely concentrated on the leading and trailing trucks, which is liable to throw more wear on the track, particularly at curves, than where the weight is more distributed. Secondly, motors of such heavy output for mounting beneath a car have to be of such compact design that full ventilation is not possible, and there is not such a wide margin of power for emergencies. Furthermore, as already noted, the carrying capacity of the tube train per ton of gross weight is lower than that of the subway, consequently, with the same speeds and headway, the tube will be able to transport fewer passengers, although its cost of construction is the same or slightly higher than that of a subway. It may be said, however, that the tunnel need not be limited to a 12 foot bore; why not drive a 16 or 20-foot tube and obtain greater capacity? The answer is, of course, prohibitive cost. Approximately the cost of a tube tunnel increases as the 3/2 power of the diameter, whilst the capacity is only directly proportional to the bore, so that the satisfactory economic limit for the latter is found to be around 12 feet, and by far the greater mileage of tube railways is 12 feet inside diameter or less.

The diagrams showing the outline features of the two forms of car also show the seating arrangements, and it will be noted that a large proportion of the floor area is given over to standing space. This is in accordance with the most approved practice; it is accepted that a number of those travelling at the rush hours will have to stand up in the cars, and the latter are so designed that they can stand comfortably rather than the alternative of providing the car with as many seats as possible and reducing both capacity and comfort.

Besides the number and size of the cars, the factors of transporting capacity are the schedule speed and the headway. Assuming that the faster the speed the better the service, it will nevertheless be found that there is a dynamical limit of around 20 miles per hour, which cannot be exceeded with trains making two stops to the mile. The economical limit is lower still. As we now have all the particulars of the weight and equipment of the cars, the speed time curves can be laid out for different schedule speeds to ascertain what value would appear most satisfactory (Figs. 6 and 7). The run curves shown in the diagram are plotted by the ordinary point-to-point method. Current is fed to the motors at a rate to accelerate the train 1½ miles per hour per second. At 11½ seconds from the start the rheostats have been all cut out, and the motors are running in full parallel at 17 miles an hour, speeding up on the motor curve. At a certain point the controller is thrown off and the train coasts, its speed gradually decreasing, owing to friction. Finally the brakes are applied rapidly, reducing the speed at the rate of two miles an hour per second, pulling up at the end of the half-mile run. Now, as will be seen, the difference between the run curves at different schedule speeds is in the point at which the controller is thrown off. Low schedules permit of early cutting off of power and a good, long coast, while to make a fast schedule the controller has to be kept on almost up to the time of applying the brakes. In each case, of course, the distance run (given by the area of the curve) remains the same, but the time taken to cover the 2,640 feet is greater or less. The curves apply to elevated and tube trains alike, because the characteristics of the motors and the kilowatts per ton are similar.



These curves relate to a train of five cars running on elevated or subway service with a 20 second stop every half mile. Equipment consists of 2 600 volt ventilated motors per car rated at 120 KW each. Initial acceleration is 1.5 miles per hour and braking 2 m.p.h. Schedule speed selected is 16 m.p.h.

Fig. 8

Inspecting the curves, it will be agreed that the 16-mile per hour schedule is away below the capacity of the equipment. For railways of moderate length, say up to ten miles from the town town loop, the 16 m. p. h. schedule would seem to be most desirable, whilst for systems of greater mileage the 18 m. p. h. speed, with fully ventilated motors, would prove satisfactory. For the purpose of this paper, 16 m. p. r. has been chosen as a happy mean, thus having a margin in hand for emergencies. The second set of curves shows the rate at which energy is applied to the motors; the area of the curves is ampere seconds, which is easily reduced to watt hours per ton mile, the most useful unit for comparing energy consumption. These amounts have to be increased by an allowance of 4 watt hours per ton mile to cover lighting heating and compressors.

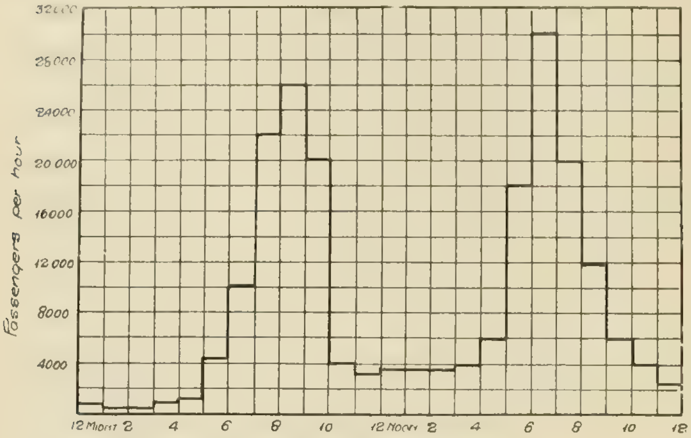


Fig. 9—Daily traffic at an urban terminal.

The next set of curves (Fig. 8) shows how the energy consumption runs up as we increase the speed of the trains. The maximum energy, however, remains unchanged, as this depends only upon the rate of acceleration. This is important as regards the feeders and sub-station equipment, which have to be figured on the maximum energy to be transmitted rather than the average.

It would be interesting to investigate still further the energy consumed by the cars; also the running costs, including energy, wages of crew, maintenance, etc., but in this paper we are concerned mainly with ascertaining what it costs to lay down a rapid transit system apart from running it. Up to the present we have figured out the probable cost building an elevated or underground railway, and have determined the type and cost of the cars, together with the most satisfactory speed. It is now necessary to turn to the prime factor in all railway calculations—that of traffic.

Traffic

Every railway has a certain tributary population that uses the line regularly. Where only one railway system exists, serving all parts of a city, the tributary population corresponds practically to the total inhabitants of the city. Where other means of transit exist the tributary population of each has to be calculated, usually upon a basis of time-saving on the assumption that the traveller chooses the quickest means of reaching his destination, except where there is a difference in the cost of transportation. An elevated line offering frequent service at 16 miles an hour will divert through passengers from the street car tracks on which a 10-mile schedule is given to a greater extent as the distance from the down-town district increases.

Table II.—Travelling Habit in Principal Canadian Cities

City.	Population.	Total journeys per year.	Journeys per inhabitant.
Montreal	600,000	155,529,438	259
Toronto	520,000	155,255,972	300
Winnipeg	233,000	53,640,490	230
Vancouver	138,000	46,330,096	336
Hamilton	116,000	17,062,871	147
Edmonton	68,000	11,886,810	175

It is, however, a mistake to generalize upon such matters, as passenger movement should be made the subject of a special study in every particular case. An estimate of the tributary population being reached, it is necessary to compute the average travelling habit, which denotes the number of rides per person per year, and varies from 300 to 360 for urban communities. For the city of Toronto the average value over the last two years was 315; in Chicago it was 334, whilst for Greater New York the figure was 356. Obviously the tributary population, multiplied by the travelling habit, gives the total number of trips over the railway per year, and at the standard five-cent fare this total, divided by 20, is the gross revenue in dollars. (See Table II.)

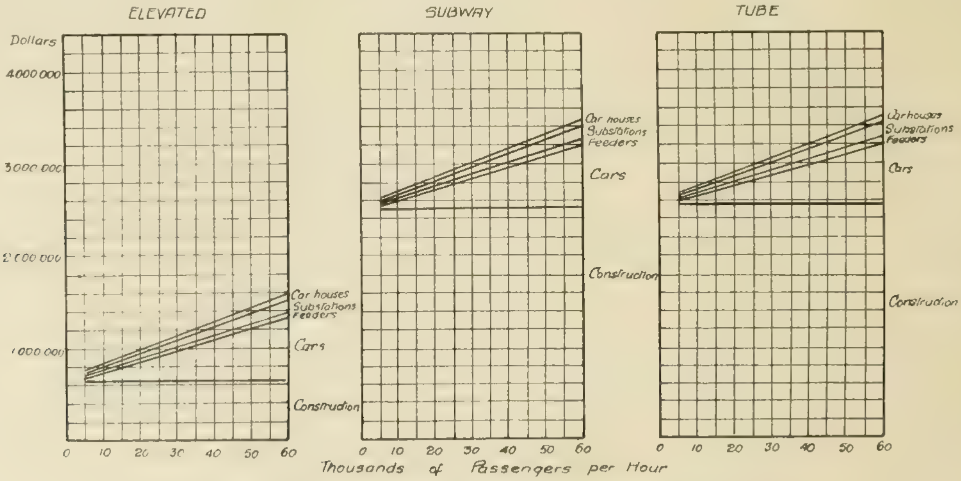


Fig. 10 The above diagrams show approximately the cost of construction and equipment of the road as related to the maximum number of passengers carried during any hour throughout the day. The cost of the cars is based upon the minimum headway plus 5 per cent. to cover stock laid up for repairs and inspection.

Peak Table

In estimating the total cost of the equipment for an electric railway we are mainly concerned with maxima. In other words, the number of trains, size of feeders, size and number of sub-stations and car houses, are dependent not upon the average number of persons carried throughout the day, but upon the maximum carried during the peak hour. On the other hand, it is the average passengers travelling from which our receipts are calculated, and this conclusion brings in the load factor. The ratio of average to maximum people travelling is always distressingly low in the case of rapid transit railways, and may in some cases be too low to render the railway a paying proposition. We have already seen that the total annual passengers can be arrived at from an estimation of the tributary population and the travelling habit. Dividing this total by 365 gives the daily total, and the problem remaining is to determine just how these passengers are distributed throughout the day. The load diagram (Fig. 9) shows the passenger distribution throughout a typical working day at a very large urban terminal handling a busy suburban traffic business. The two peaks are characteristic of rapid transit service, and, as a rule, the evening peak around 5 o'clock is the greater one, forming the determining factor in the equipment of the road.

Taking the number of passengers travelling at the busiest hour of the peak and dividing it by the capacity of one train, we obtain the maximum number of trains required per hour to transport this number. It is a safe plan to take this flow of passengers as being unidirectional, because few will be travelling down-town at the time of the evening peak or uptown in the morning. If the rapid transit lines radiate out in two or more directions from the down-town zone the best manner is to treat each line separately in this calculation. The number of trains per hour, divided by the schedule speed in miles per hour, gives the number of trains per mile of single-track. As all our conceptions have been based upon a mile of double track, this figure of trains per mile must be multiplied by two. We are thus able to find the actual cost of the trains as related to the number of passengers travelling at the rush hours. Given the number of trains operating, it is an easy matter to figure the feeders and sub-stations; also to form some estimate of the car-house and repair shop capacity. These figures are totalled up in Table III. and Fig. 10.

Total Cost

Referring to Fig. 10, we are now able to form some conclusions of our own relative to the cost of rapid transit in cities. Just by way of an illustration, let us assume 30,000 passengers per hour as the maximum rush. We see that to build and equip an elevated road to handle this traffic density would cost slightly over one million dollars per mile of double track, whilst a subway to give the same service would cost three million dollars. This, however, is a fairly high traffic density; for lighter traffic the construction cost bulks still larger, as compared with the equipment. Particularly with underground railways does this apply. The extremely heavy cost of construction quite overshadows that of equipment and adds weight to the argument that subways are not justified save as a last resort, where no other means of handling the traffic are permissible.

Table III.—Total Cost of Equipment for Rapid Transit Railways

(A) Elevated and Subway Lines

Pas'g'rs per hr., max'm.	Trains per hr	Trains per mile.		Cost per mile, double track				
		Single.	Double.	Trains.	Feeders.	Substations.	Car houses.	Total.
10,000	11.1	.70	1.40	118,000	7,000	22,400	14,000	$161,500
20,000	22.2	1.25	2.50	210,000	12,500	40,000	25,000	287,500
30,000	33.3	2.08	4.16	350,000	20,800	66,600	41,600	479,000
40,000	44.4	2.78	5.56	465,000	27,800	89,000	55,600	637,400
50,000	55.5	3.47	6.94	584,000	34,700	111,000	69,400	799,100
60,000	67.0	4.20	8.40	703,000	42,000	135,000	84,000	964,000
(B) Tube Lines								
10,000	15.5	.97	1.94	109,000	9,700	31,000	19,400	169,100
20,000	31.0	1.94	3.88	218,000	19,400	62,000	38,800	338,200
30,000	46.5	2.90	5.80	325,000	29,000	93,000	58,000	505,000
40,000	62.0	3.90	7.80	437,000	39,000	125,000	78,000	679,000
50,000	77.5	4.85	9.70	545,000	48,500	155,000	97,000	745,000
60,000	93.0	5.80	11.60	650,000	58,000	170,000	116,000	894,000

Montreal Electric Luncheon

For the most part An address by Mr. B. K. Sandwell, editor of the Financial Times, at the Montreal electrical luncheon on May 2, consisted of humorous remarks, which delighted and amused a large gathering. His subject was "Reflections On a Lighting Bill." The concluding part of the address was devoted to a vigorous criticism of government ownership of electrical industries, particularly in relation to Ontario plants. In parts of Canada, he said, there is beginning to be a feeling that because water comes down freely from heaven and collects into rivers, which, according to the British North America Act, are the property of the province in which they happen to run, therefore the people who take this water and turn it into electricity and sell it to the consumer and make a profit out of it are robbing the community. Gentlemen with thunderous voices and a great flow of words get up on platform and say: "These are our water-powers; why should should anybody make a profit out of them?" And if you show them that their own legislators, fifteen or twenty years ago, when the electric business was in its infancy and just beginning to toddle across the room, gave to these companies the right to make a profit if they could get one, as well as to pay the loss if they couldn't, then our thunderous-voiced gentlemen say: "Oh, but that was before we understood about these things! We can't stand for it now. We're going to take it back; and, anyhow, those legislators of fifteen years ago were probably not honest, whereas our legislators of to-day are notoriously as honest as the sun." In parts of Canada, by various means and devices and by the use of the sovereign power of the state and the unlimited credit of the taxing authorities, these thunderous-voiced gentlemen are actually taking away from long-established electorical companies the rights which were expressly conferred upon them by the state, or driving them out of business by competing with them at cut-throat prices at the expense of the taxpayers.

You may think that here in the Province of Quebec we are secure against the economic heresies held to be quite orthodox in some provinces, which are becoming so prevalent in other parts of Canada, but it is impossible to tell from one decade to another what may happen, especially in regard to changes of public opinion. All over Canada there are signs of a growing disposition to disregard the rights of invested capital to obtain a reasonable return on its venture and a proper remuneration for its risks. But I warn you, as electrical men, that the spread of this economic heresy means the end of all progress in the electrical industry, for capital will no longer be available for enterprises whose future is subject to the shadow of confiscation.

New Book on Wiring

Wiring for Light and Power—by Terrell Croft, McGraw-Hill Book Company, Inc., publishers; price $2.00; flexible cover, pocket size, 430 pages, 382 illustrations. The purpose of this book is to supply explanations, elaborations and illustrations for those sections of the National Electric Code to which it is necessary for electrical worker to refer most frequently. The book has incorporated in it, verbatim, the most important National Electrical Code regulations. These regulations and their application in practical electrical construction are explained by supplementary text and fully illustrated. In most cases, where such explanations are feasible and available, the reasons for the adopting of the Code rules are discussed by the author. The book is particularly well indexed, a feature that will be appreciated by the average user. This latest work of Mr. Croft's should be of the greatest value to those workers whose aim it is to install their work so that it shall be at the same time electrically safe and mechanically secure.

The Dealer and Contractor

Use Your Windows to Sell Electric Goods—Don't Underestimate the Value of Suggestion and Actual Demonstration

By W. B. Stoddard*

This might well be called the age of Electricity, since it is being introduced into the homes in so many forms. There is good profit in electrical goods and most up-to-date merchants are now handling them. Their sale would be vastly increased, however, if they were displayed in a more attractive form. To most people electrical utensils are something of a mystery, and a mere showing of them will not impress their advantages upon the average housewife. What is needed is an actual demonstration of their practicability, and if they are shown in actual use, or at least in the hands of wax models, their convenience will at once strike home. This will be especially true if succinct cards stating just how much labor and worry they save are posted alongside the figures. Just to quote a few displays that could be arranged by the average merchant—displays which would move a dead line into the living class—it might be noted that:

The Electric Shop, in a large city, featured electric hair curlers and dryers. One window was draped in salmon silk, and showed two wax busts such as are used by hairdressers. One of these had her elaborately coiffed, and in front of her was an electric curling iron. The other had locks floating free, in the process of being dried by an electric dryer. Between the two was a card:

> "DO IT ELECTRICALLY AND
> SAVE TIME
>
> No worry about getting the iron too hot, you maintain any temperature you desire.
>
> No hanging the head out of the window to dry the hair; you do it in ease and comfort.
>
> Electric hair curlers, $1.35 to $4.00.
>
> Electric hair dryers, $9.00."

Their other window is even more effective, for it shows a section of a lady's boudoir. Seated before a dressing table of ivory enamel is a woman in dressing gown of blue crepe de chine. The floor is spread with blue rag rug, and the curtains are of old gold damask. A stand in one corner holds a vase of red carnations. The dressing table is spread with the usual feminine impedimenta, and the lady sits in a low-backed dressing chair. She is curling her luxuriant locks with an electric curling iron, and the large mirror before which she is seated enables the spectators to see the entire modus operanda of the proceedings. It is a sight [illegible] so simple and effective [illegible] toilette.

[illegible] display of another firm shows that electricity [illegible] advantage in the kitchen as in the [illegible] the sale of laundry supplies and simple morning dresses. A familiar ironing [illegible] caused many to smile—the ironing board laid across the back of two chairs. Before it stood a young woman in long checked gingham apron, and cap, ironing a white shirt. There was no weary trotting back and forth, however, as she was using an electric iron, attached to a cord, with socket in the side wall. Back of her was a three-armed rack filled with towels. A pyramid of copper tubs of graduated size stood in one corner, and in the other was a large clothes basket and bag of clothes pins. At the other side of the room was an electric washer, operated by a pulley, and during certain hours of the day this machine was seen in actual operation to the interest and information of many a weary housewife and her good man. A sign advised:

> "WHAT MAN WOULD DO HIS WORK
> TO-DAY WITH THE CUMBERSOME
> TOOLS OF HIS GRANDFATHER?
> Show yourself a true MAN, then, and equip your wife with the same up-to-date household machinery as you are using on the farm or in the office."

It was a display calculated to set many a man to thinking—with results favorable to the merchant showing the twentieth century household machinery.

Another sight to appeal to all mothers was the window which showed a corner of a nursery, with an electric grate at one side. On a big fur rug before it was a chubby youngster of two, in white dress, his arms about the neck of a papier mache dog (which bore a striking resemblance to the one made famous by the Victor talking machine—"His Master's Voice.") A dilapidated doll, and a little horse on wheels gave a very natural finishing touch to the picture, while the card said: "Warm Friends." Another card says:

> "Nothing is so precious as the health of the
> Baby—Keep the room at an even
> temperature by an
> ELECTRIC HEATER
> It will prove a WARM FRIEND
> to baby and mother."

Demonstrations of electric heaters are particularly appropriate during the chilly mornings of spring and autumn, when one does not want a big furnace fire, yet something is needed to take the chill off the rooms in the mornings. A corner of a living room was shown by a well-known dealer with rug, easy chair, hangings of golden brown tapestry, a table on which were several magazines and a great vase of red roses. On the table was an electric lamp with shade of yellow silk, and an electric heater stood near the chair. A sign said, "Electricity is now within the reach of all—solid comfort for the home." About the wall were a number of catchy signs calculated to set people to thinking:

> "Was it chilly in your bed room this morning? Of course it was. You could hardly dress. Don't do it again because you will catch cold. Order one of our ELECTRIC

---

*[illegible] Contractor

> HEATERS, light it, and in a few minutes your room is warm."
>
> "There never will be a better time to buy an ELECTRIC HEATER than right now. Be prepared to ward off Old Jack Frost."
>
> "If you have not ordered an ELECTRIC HEATER for your room, do it to-day. Be warm and comfortable these cold nights."

In another window they had a novelty which could be advertised with equal effect in the electrical or toy department—in fact, publicity in both would work to its advantage This was a miniature electric range a foot high. With it were the regulation pots and pans of aluminum. Card board cut outs of two little girls were shown, but it would be more effective if wax models of little girls were used. A card over the little range said:

> "A NEW TOY FOR GIRLS.
>
> A miniature cook stove—practical and safe. Teaches the girls to cook in the guise of play. A delight for little lasses."

Natural Resources Survey

Mr. E. G. de Coriolis, of Arthur D. Little, Limited, Montreal, read a paper on the "Natural Resources Survey" at the Montreal electrical luncheon held on Wednesday, April 18th. He briefly traced the development of the cartel system in Germany, which permitted the Germans to undersell their competitors in almost every foreign market, and spoke of the dependence of many countries upon Germany for materials so essential as dyes, chemicals, potash, etc. The outbreak of war resulted in the collapse of this immense foreign trade, and they were all beginning to realize that after all the world could get on very well without German-made goods, and except in a few instances, manufacturers found it possible to replace the German products by other materials made in the United States and Canada, which, although they might be more costly, were nevertheless, as a whole, far superior to the hitherto imported articles of Teutonic origin.

This led to a consideration of the development of Canadian natural resources, the speaker mentioning that an extensive deposit of china clay is being developed north of Montreal and is supplying a high grade product fully equal to the best imported Kaolin. Magnesite, so essential in the production of linings for steel furnaces, and which before the war came exclusively from Greece and Galacia, is now being quarried and calcined in the Laurentian Mountains, and supplies the steel mills on this continent. These were only two examples of Canada's natural resources which had been lying dormant and which in the stress of circumstances had been developed to play an important part in industrial life. The question naturally arose whether this was all that Canada could do, or whether it would not be possible, by getting a more comprehensive grasp of the available resources of Canada to proceed more actively with their development. In the spring of 1916 Lord Shaughnessy decided that something had to be done, and the C. P. R. had retained the firm of Arthur D. Little, Limited, to undertake this work, now being embodied in a survey of the natural resources of the Dominion. It was the initial object of the survey to recast into quickly available form the immense mass of valuable information regarding Canadian resources now stagnant in Government publications, scientific and technical journals, corporation records, and special reports of individuals. It was therefore proposed to extract this data and transfer the salient and important facts regarding agriculture, mines, minerals, water powers, forests, fisheries, and furs, to standardized form capable of close classification, and to so control and key the information that related groups of facts might be properly furnished as required. The survey would be impartially conducted for the benefit of all, and with the sole purpose of advancing the industrial development and prosperity of the Dominion. The plan of the survey further provided for the prosecution of industrial research on lines selected for their promise of yielding results of broad general benefit or of immediate advantage to individual communities or industries. Several such researches were already in progress, among which might be mentioned a series of co-ordinated studies which had for their object the industrial utilization of cereal straws.

Mr. de Coriolis then gave statistics illustrating the enormous resources of Canada and laid particular stress on the water powers. He stated that the water power within accessible distance totalled 17,000,000 horsepower, of which only 10 per cent. had been developed, yet, as they were aware, there was a continuous demand for power, much of which could be utilized for electro-chemical and other products.

At the same time Canada could not produce all she consumed. Her population was small and scattered outside of a few cities, and in addition the resources were not all located in the same place. Transportation, both in regard to the raw and finished articles, was also an important factor. It was hoped, however, that as a result of the survey now being made they would be able to find out which of the resources they could afford to develop, and which were the ones that would have to await for their development the influx of population, which, it was hoped, would take place after the termination of the war.

The Ball is Rolling—Keep it Going

The Toronto Electrical Contractors held another very successful dinner and meeting at the Carls-Rite on Monday evening, May 7. Some 45 contractors were present, a particularly happy feature of the attendance being that every one of the thirty-seven paid-up members of this new organization were on hand.

The evening was occupied chiefly in the election of officers. As already announced, Mr. K. A. McIntyre is the president; the other members of the Executive are as follows: Vice-president, Mr. Harry Hicks; secretary-treasurer, Mr. J. E. Myers; committee, Messrs. George J. Beattie and W. H. Douglas.

The Provisional Executive are greatly to be congratulated in having brought the organization of the association to such a successful head. Much hard work has been involved and probably few members of the association realize just how much time, patience and energy have been expended by Messrs. McIntyre, Hicks and Douglas, during the last few months, to bring the present results. It is very satisfactory to note that all the members of the Provisional Executive have been re-elected.

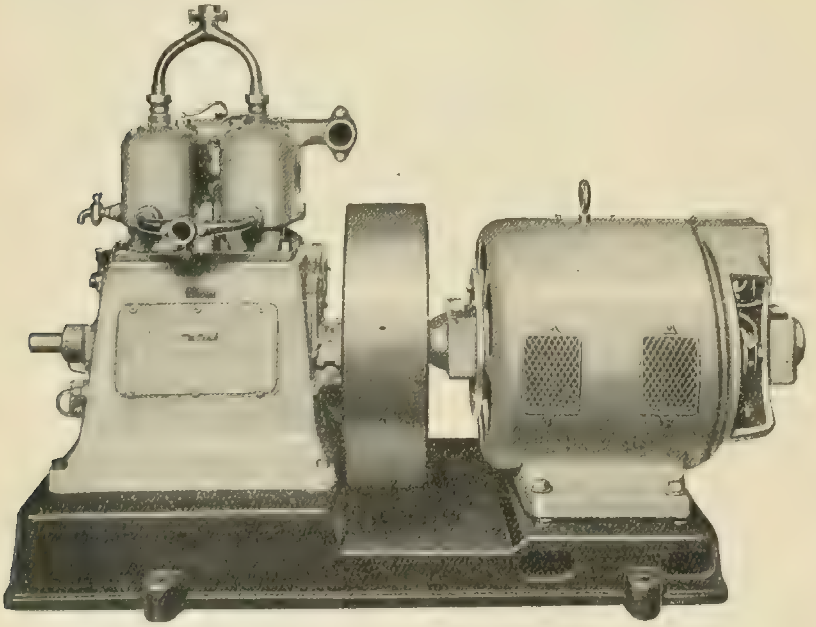
The whole thing has simply been a matter of "work." Mr. McIntyre, more particularly perhaps, has been unceasing in his determination to rouse and maintain the interest of electrical contractors in themselves. There are so many little problems, in which unity means strength and success. Now that the wheels are moving easily it is every contractor's duty to see that he contributes his share of "oil" towards the proper maintenance of the organization. This must not be interpreted to mean simply paying the yearly and initiation fees. It is more than that. The success of the new organization depends very largely on the amount of real personal assistance each member renders. Let every electrical contractor look upon it as a part of his business organization and take the same interest in it

Electric Light and Power in the Country

The farm, or country home that finds itself located in the vicinity of Hydro or other electric transmission lines is fortunate indeed, but as yet these represent a small proportion of the rural demand for electric service. The vast majority of country homes cannot hope, in many years, to be served by central stations. With the urgent demand for the modern necessities as at present developing it follows, therefore, that the countryman must look to the small isolated plant.

This alternative, however, is much more promising than was the case a few years ago. The number of factories manufacturing this type of equipment has been multiplied and the operation of the plants simplified. And with simplification has also come reduction in cost, so that electric light and power at rates quite comparable with those given in many towns and cities is now available on the farm and in the summer home.

A big advantage of these plants is that they can be used for so many purposes in addition to lighting—all the little domestic uses, ironing, washing, toasting, etc.; for pumping water, and also for the very important use of charging storage batteries. These are not only used in the automobile and the motor launch, but frequently also as the motive power for small boats. The storage battery driven boat is an ideal outfit for hunting and fishing on account of the entire lack of odor and noise. For the same reason its use as a pleasure craft is becoming more common each season, particularly where only a narrow range of action is desired.



The Lister-Bruston automatic plant.

Below we give a brief description of a variety of small plants now available in Canada, with illustration in each case. Capacity ranges from 175 watts up, and prices, we understand, from about three hundred dollars up.

The Lister-Bruston Set

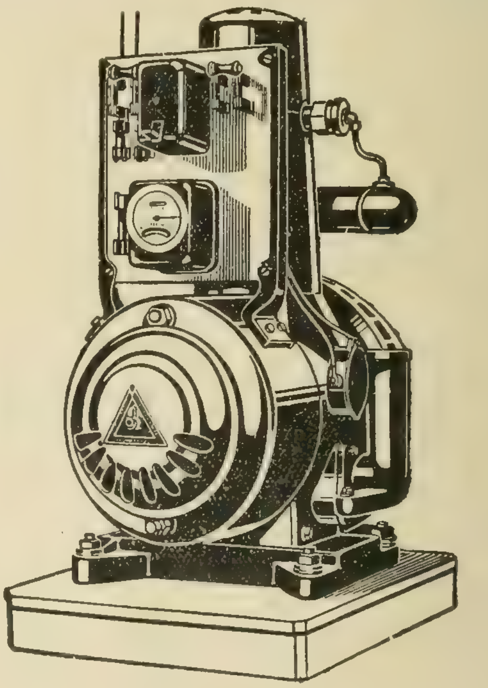
This is an entirely automatic system. It consists of the engine and generator, switchboard and small battery. The battery is of smaller capacity than the generator and is intended for night, emergency or very light service. The plant is automatic in that when a demand beyond a certain percentage of the battery capacity is required the generator is automatically set in operation. Provision is also made for automatically starting the engine in case the battery is becoming discharged through continuous use at low capacity. This plant is made in capacities ranging from 520 watts to 20 kw., and in voltages, 57, 110, 220. In capacities of 26,000 watts and under, the generator is belt driven by a single cylinder engine. Above this size the engine and generator are direct-connected.

Delco Light

The Delco light equipment which has been recently placed on the Canadian market is also illustrated. It consists of an engine direct connected to the generator, with switchboards and batteries. The storage battery consists of 16 glass jars delivering 32-volt current. This is kept continually charged by the engine, and unless the demand for light and power is very heavy, the engine is not used except when the storage batteries require recharging. The capacity of this plant is 32, 16 c.p., 20-watt lamps.

Gralectric Lighting Plants

One of the illustrations herewith shows the lighting plant known as the Gralectric, being marketed by Gray Motor Company. The plant is made up as a complete unit, mounted on skids, and is shipped to the customer with the batteries fully charged, so that, if his house has been previously wired, he can have light immediately after uncrating. Gralectric plants are of the 30-volt, semi-automatic type, provided with a means for starting the engine by using the dynamo as a motor. A special device is employed, by means of which the motor starts slowly yet with plenty of torque, so that there is no serious drain on the batteries in starting. The switchboard contains voltmeter, ammeter, automatic cut-out, rheostat, starting switch, and fuses; also name-plate, on which full instructions are given for charging. The switchboard is so arranged that the manual operations have been reduced to that of throwing in the switch to start the engine for charging or for running the generator to obtain extra capacity for



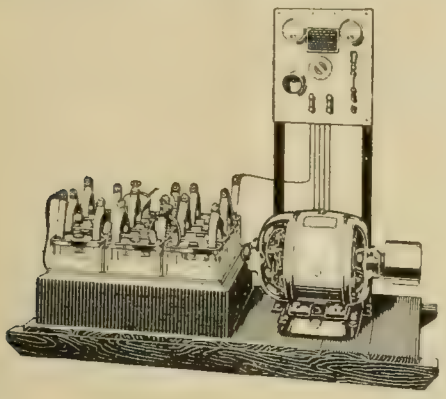
Delco direct-connected unit.

operating electric irons, vacuum cleaners, etc. Gralectric plants are made in the following sizes:

No. 1—25- light plant. Includes 15-cell, 32-ampere hour, Faure type storage battery, a 9-ampere, 40-volt generator, and switchboard with automatic cut-out, etc.

No. 2—35-light plant. Includes 15-cell, 40-ampere hour, Faure type storage battery, a 12½-ampere, 40-volt generator, and switchboard with automatic cut-out, etc.

No. 3—60-light plant. Includes 15-cell, 60-ampere hour, Faure type storage battery, a 20 ampere, 40-volt generator and switchboard with automatic cut-out, etc.


The Gralectic--Semi-automatic.

The special advantage claimed for this plant lies in the fact that it can be operated by the ordinary farm engine that is now part of the equipment of many an up-to-date farmer or owner of a country home. The plant is belted to the flywheel of the engine. The details of the plant have been simplified to the last degree, and its manufacturers claim that any boy old enough to read an instruction book can take care of it successfully.

Main Electric

The Main Electric Manufacturing Company are now placing on the market their new plant, shown herewith, which has an output of forty 20-watt lights. The same company is building a trifle smaller size with a capacity of 25 lights, or 500 watts. These plants generate at 30 volts. This company also manufactures both smaller and larger plants, the smaller ranging as low as 175 watts. The latter is a portable type. Portable types are also built up to 1,000 watts capacity.

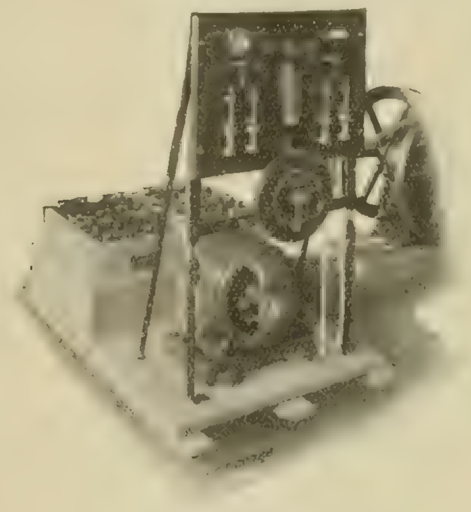
The 'Main' unit - From 175 watts up.

The Alco Plant

Another excellent equipment is that supplied by the Automatic Light Company, known as the Alco machine. This includes a 110-volt generator, and the system is operated, in general, without batteries, there being only a 6-volt battery, which is used for starting purposes or for night lighting. The capacity of the standard machine is 30 20-watt lamps, or 600 watts, so that it is capable of supplying an iron or a toaster or any one of the average household appliances, as well as small motor machinery not exceeding [illegible] h.p. The engine consists of a one-cylinder, four-cycle, gasoline type, direct-connected to a G. E. generator. The two main advantages of the standard voltage are that the ordinary appliances can be utilized, and that current may be transmitted a greater distance without appreciable loss. The plant starts and stops automatically by the turning on or off of a light or power load.

The C G.E. Hyray-Exide

The "Hyray-Exide" is another economical little outfit now being sold by the Canadian General Electric Company. The plant consists of "Exide" batteries manufactured by the Electric Storage Battery Company, a switchboard, and a generator, all mounted on a skid. It has a capacity of about thirty twelve c.p. lights.


The Hyray-Exide 30 12 c.p. lamps.

Mr. Lodge Joins Inspection Staff

The friends of Mr. W. H. Lodge will be pleased to learn that he has been appointed to the staff of the Electrical Inspection Department of the Hydro-electric Power Commission of Ontario for the district of Toronto. Mr. Lodge's many years of practical and successful experience in the electrical contracting business and his intimate knowledge of conditions will make him an ideal appointee for this position.

Personal

Mr. John G. Barry has been appointed general sales manager of the General Electric Company, Schenectady. Mr. Barry has been a resident of Schenectady for the past twenty years, and his friends will be glad to learn of his advancement and increased responsibilities. Mr. Barry continues his present duties as manager of the railway department.

Mr. W. H. R. Gould, Uxbridge, Ont., left for England on April 25, to join the Royal Naval Air Service. Mr. Gould is an honor graduate in electrical engineering from the University of Toronto, and received his lieutenant's certificate at Niagara Camp in the summer of 1915 with the C.O.T.C. Since graduation he has been superintendent of the Uxbridge electric light plant. He already has a brother in [illegible] in France.

Current News and Notes

Alliston, Ont.

The town council of Alliston, Ont., have voted $32,000 for the purpose of taking over the Alliston electric light plant and repairing and improving it for the distribution of electric light and power to be supplied by the Hydro-electric Power Commission of Ontario.

Aylmer, Ont.

The ratepayers of Aylmer, Ont., recently carried a by-law with a majority of 288 to install a hydro-electric system. The power will be brought from St. Thomas and the system is expected to be in operation within three months.

Grand Forks, B.C.

The city council of Grand Forks, B.C., have established a rate of 4 cents per kw. for heating and cooking purposes.

Greenfield Park, Que.

The town of Greenfield Park, P.Q., has made arrangements with the Montreal Light, Heat, and Power Company for the supply of power in connection with the proposed new street and house lighting system.

Hamilton, Ont.

The Hamilton Hydro-electric Commissioners will advertise a sale of electric ranges.

Hanover, Ont.

A by-law was recently passed in Hanover, Ont., authorizing an agreement with the Hydro-electric Commission of Ontario. The new system will be proceeded with immediately.

Kingsville, Ont.

Fire recently did $150,000 damage to the car barns and power plant of the Windsor, Essex and Lake Shore Railway.

MacNutt, Sask.

The Gorra-MacNutt Rural Telephone Company, MacNutt, Sask., are receiving tenders for 12½ miles of extension to their line.

Montreal, Que.

Major Howard Church Symmes, killed in action while serving with the South African Infantry, was a graduate in science, McGill University, 1897. After serving through the South African campaign with the artillery from Guelph, Ont., he was employed as an electrical engineer in the Bureau of Mines at Johannesburg. He was the son of the late Mr. T. Symmes, of Aylmer, P.Q.

Mr. J. N. Groleau, of the Bell Telephone Company, formerly district superintendent in charge of Districts Nos. 3 and 4, with headquarters at Montreal has been made district traffic superintendent at Montreal.

ALUMINUM
ELECTRICAL CONDUCTORS

Ingot Sheet Wire Rod Tubing

Northern Aluminum Co. Limited
1305-6 Traders Bank Bldg.
Toronto, Ont.

Mount Forest, Ont.

The lighting rate for street lamps at Mount Forest, Ont., has been reduced from $12 to $10, a saving of $342 per annum.

Pickering, Ont.

Pickering Village and Pickering Township are shortly to be supplied with electric light and power through the Hydro system. The line is to be extended westward from Whitby along the Kingston Road to the Village of Pickering and thence northerly to Claremont.

St. Thomas, Ont.

The St. Thomas city council have under consideration extending the street railway line to Pinafore Park, building an $8,000 trestle at Elm Street hill.

Winnipeg, Man.

One hundred men in the employ of the Winnipeg Light and Power Plant went on strike on May 2.

Arrangements are already being made in Winnipeg for a bigger and better electrical show for this fall than was the very successful one held last October.

Wolseley, Sask.

The town council recently passed a $9,000 by-law providing for extensions to the municipal light and power plant.

Trade Publications

Residence Panel Board—Bulletin No. 1-B, by the Crouse-Hinds Company of Canada; describing and illustrating residence panel boards.

Condulets—Catalog No. 1000-G, issued by the Crouse-Hinds Company of Canada, illustrating and describing "Iron-clad" switch condulets, MK and MF series.

Lighting Fixtures—Catalog C-1, published by R. Williamson & Co., Chicago. This catalog illustrates only the most staple items in lighting fixtures, such as are in general demand; profusely illustrated.

C. G. E. Publications—Leaflet, small battery charging outfits for charging ignition and lighting batteries; leaflet, float switches for automatic pumping equipments; bulletin No. 49711, electric vacuum furnaces.

Electrical Specialties and Reflectors—Catalogue No. 16, by Harvey Hubbell, Inc. In this catalog the idea has been introduced of arranging in chart form all sockets, pull switches, attachment plugs, receptacles and reflectors. The interchangeability of the various lines is clearly demonstrated by illustrating at the side and top the component parts and where the imaginary lines drawn from the component parts converge, the assembled parts are illustrated.

Headlights—The Electric Service Supplies Company has just issued a new and very comprehensive catalog on "Golden Glow" railway headlights and projectors. This catalog describes, as well, a complete line of dimming and main resistances and a complete line of switches and other headlight accessories necessary for use in connection with the railway headlights. This is a 64-page book, printed in two colors, in the production of which much effort has been expended in reproducing the appearance of the different headlights as they really are.

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Technical Men Helping with Questionnaire No. 3

Plans are practically complete for sending out Questionnaire No. 3, which has been prepared by the Honorary Advisory Council for Scientific and Industrial Research. The object of this questionnaire is take an inventory of the research equipment and needs of the several thousand industrial establishments throughout the Dominion. These are being approached individually, so as better to insure the return of prompt and correct information.

The Advisory Council has called to its aid in this matter the technical societies of the Dominion, which have unanimously demonstrated their willingness to do everything possible to further the collection of this information. These organizations include the Canadian Society of Civil Engineers, the Canadian Manufacturers' Association, the Canadian Mining Institute, the Society of Chemical Industry, and the Joint Committees of Technical Organizations recently formed in the various provinces.

The actual work of organization for collection has been placed in the hands of a central directing committee. of which Mr. R. A. Ross, member of the Advisory Council, is chairman, and which also includes one member each from the C.S.C.E., the Canadian Mining Institute, the Society of Chemical Industry, Canadian Manufacturers' Association, and the Joint Committee of Technical Organizations, Ontario branch. This central committee has organized a general plan of division of territory, and apportioned the work of distribution among the volunteer organizations according to the facilities which each possesses in the respective divisions. By this plan British Columbia is being covered by the C.S.C.E. and the Canadian Mining Institute; Alberta, by the C.S.C.E. and the Canadian Mining Institute; Saskatchewan, by the C.S.C.E.; Manitoba, by the C.S.C.E.; Ontario, with the exception of the Ottawa section, by the Joint Committee of Technical Organizations, Ontario branch; the Ottawa section is being handled by an Ottawa joint committee; Quebec will be covered by the C.S.C.E., and the Canadian Mining Institute; the Maritime Provinces by the Joint Committee of Technical Organizations, Maritime branch.

It is hoped that the members of these various organizations will hold themselves personally responsible for seeing that the manufacturers in their district are sufficiently interested to fill in the required information and return it promptly to the Advisory Council. It is presumed that engineers can assist in this way not only by using their personal influence, but by giving such information of a technical nature as may be useful in assisting the different manufacturers to prepare the information required. Technical men throughout the Dominion are urged to make this a matter for their personal and earnest attention. In so doing they will be performing a patriotic service to their country and be assisting materially in bringing our war to a successful and early issue.

The Scope of the C.E.A.

The members of the Montreal company section of the Canadian Electrical Association held their first regular meeting on May 16, at the Central Y.M.C.A., Montreal. The gathering was for the purpose of explaining the scope of the Canadian association and of the National Electric Light Association. Mr. George B. Muldaur, of New York, the field secretary of the latter organization, gave details of the activities of his association.

Mr. James Wilson, the chairman, referred to the encouraging start made by the section. It was proposed, he said, to have papers and addresses, with discussions, during the next winter season. It was surprising that a section had not been formed at an earlier date.

Mr. D. H. McDougall, president of the Canadian Electrical Association, Toronto, gave a cordial greeting to the new section. Such meetings provided the means of disseminating information and broadening the views of the members. Every community had its own problems, and the electrical problems of the members being similar, the meetings should be helpful in solving those problems. The N.E.L.A. was founded largely on the spirit of co-operation, and it was by the exchange of ideas that they would receive mutual benefit. It was incumbent upon them, as central station men, to carry out this co-operative method to its fullest extent. Co-operation was essential to the success of the public service business.

Mr. Muldaur also brought the hearty greetings of the N.E.L.A., which he said were all the more cordial owing to the entry of the United States into the war. The association had this year given up its convention and substituted a short conference, almost the entire time of which was devoted to a discussion of how the industry could best serve the country in co-operation with the government. The N.E.L.A. had elected Mr. McDougall one of its vice-presidents and Mr. McDougall's speech at the conference was an inspiration to the members. Mr. Muldaur then explained the working of the N.E.L.A., mentioning that he had just made a tour of the States and had also visited British Columbia. The membership had largely increased during the year, and was now in excess of 15,000 members. There were 70 central committees. The geographic and allied sections of the association were able to take care of their own affairs, leaving to the central [illegible] the [illegible] questions of policy, etc. There were [illegible] company sections, this being the youngest branch of the association. The main objects were to increase the value of the employee to himself and to the company, to bring men together, and above all to educate them in the particular lines in which they were engaged—in a word, to increase their efficiency. It also brought home to all the dependence of the company upon the public and the dependence of the public upon the company. The operations of the sections had been worked out as the result of long and diverse experiences, and it had now reached a point of comparative perfection. Mr. Muldaur gave details of the social and educational activities of the association referring to the value of the group system as far as the educational work was concerned. He also spoke of the welfare work, papers, and of the various prizes offered by the association.

U.S. Technical Organizations Heartily Co-operate in War

If one may judge by the expressions of loyalty to and promises of co-operation with, their president, on the part of the many technical organizations in the United States, the sentiment in favor of abandoning their policy of neutrality finds almost universal favor in that country. It is an old warning to beware of the patient man when he finally loses patience, and there is good evidence that the United States is preparing to lend vigorous assistance to the Allies in their struggle for freedom and civilization.

From the least significant to the largest and most important, the technical societies of that country appear to have come forward spontaneously to offer their unqualified aid to the president. That is the first step towards getting results, and it is to be hoped President Wilson will show a proper appreciation of the possibilities underlying these offers. No doubt he will do so, for the United States Government has given unmistakeable proof already that it means to take a real part in the struggle. This is shown in the appointment of one of their biggest engineers to have charge of national shipbuilding work, the appointment of a food controller, the immediate co-operation of the navy, and in many other ways. These are evidences of co-operation that Canada, as part of the British Empire, joyfully recognizes as an official guarantee of the innumerable unofficial assurances of good-will and sympathy with which we have been regaled during the past two and a half years.

The United States electrical industry, too has early recognized its value as one of the basic organizations on which the new machine must be built up, and, very much as we did in Canada, the men of this industry are determined that the business of the country shall go forward, not "as usual," but "as necessary." "Time, money, and energy must be conserved, but business must go on."

Typical of the attitude of electrical men all over the United States is the recent action of the Society for Electrical Development, which met in convention in New York on May 8, and in connection with which we have the following report:

Business Must Go On!

That the success of the United States in helping to win this war depends not alone on its military forces, or its ships or its food supply, but upon keeping business moving, was the sense of a declaration issued at the recent annual meeting of the Society for Electrical Development. Following is the [illegible]

A Resolution of the Society for Electrical Development, Inc., Passed May 8, 1917

[illegible] the President [illegible] to the people [illegible] co-operation of all resources and the devotion of all energies to the sole purpose of bringing victory to the arms of the nation in the war upon which it has so justly entered;

Resolved, that this society, at its annual meeting, pledges to the President its patriotic support of all measures which he may take in upholding the dignity and honor of our country, and the rights, property, and persons of its citizens on land and sea;

Resolved, that America's success in helping to win this war depends not alone on its military forces or its ships or its food supply, but first of all upon our ability to keep the wheels of mercantile business going.

Resolved, the business of this country must go on, and we pledge our active support to the movement by which every business man in this country agrees to hold up his link in the chain of mercantile enterprise, including the preparation of all electrical systems for the added demands, both military and industrial, which may be made upon them.

The sense of the meeting can be summarized as follows:

More than men, more than money, and more than food products and munitions will be required to bring the war to a successful termination. Time, money, and energy must be conserved, but business must go on. To paralize internal commerce and industry will surely bring disaster now or later.

To conserve resources, however, does not mean to reduce purchases to the minimum nor to reduce all activities to the bare necessities of life. To conserve is to eliminate waste, to spend judiciously, to employ labor-saving devices to the maximum so that time can be devoted to the country's needs. All will be called on for sacrifices of money, time, and energy. To be able to meet these calls our daily tasks must be done as quickly as possible and with as little fatigue as possible.

The position of the electrical industry in this campaign to keep business moving should be most prominent. There is no other conserver of time, labor, energy, and money that can compete with electricity. Electricity in the factory means means a larger output with less loss and at lower expense. Electricity in the office means a larger day's work in fewer hours and with less fatigue. Electricity in the home means a saving of time, the elimination of drudgery, and more time for the housewife to devote to the country's needs. Electricity on the farm means more work in fewer hours and a larger production of the foodstuffs for which the world is crying, with less hired help.

Electricity in every walk of life means a maintenance of production with a reduction of the number of laborers required. The only commodity effecting our lives that has not increased in cost is electricity. One thousand per cent. more effective electric light can be obtained to-day than twenty years ago, at the same expense. Electrical machines are available for most of the operations calling for manual effort, so that to "do it electrically" is to do it quicker and easier.

Thus, the electrical industry is in an especially advantageous position at this time. Business must go on, and by keeping the electrical business going the nation is being helped materially. That is the ultimate aim of every true American at this time. Each one wants to do his most and best for his country; the individual has become of secondary importance, except that by helping the individual the nation will be helped.

There is bound to be a shortage of labor in every branch of human endeavor. Factories will be short-handed. Farmers will be without the necessary "hands." The woman in the home will be forced to do her own work. Offices will be short of clerks. Electricity and electrically-operated appliances can help solve the problem of this labor shortage

Machines, electrically operated and almost automatic, can successfully take the absent laborers' places.

Business must go on, and will go on, to the advantage of all when men realize that conserving resources means the elimination of waste and judicious spending—not the hoarding of money and the reduction of spending to the limit. Let the electrical industry get this firmly fixed in its mind along with the fact that electricity and electrically-operated appliances are the greatest labor, time, and money conservers.

Electric Cooking and Heating

At a recent convention of the Pacific Coast section of the N.E.L.A. a report was presented by the Commercial Division on the subject of electric cooking and heating. This report is all the more valuable in that a wider experimentation has probably been made in these subjects in the Western United States than in any other place on the continent. It is true current is not so cheap there as at different points in Canada, but climatic conditions apparently are such that the use of electricity for cooking, and even more for heating, is so overwhelmingly attractive that considerable scientific research has been carried on looking to the perfection of methods and reduction of cost.

The following quotations have reference to the heating of water for domestic puposes in connection with which the report states the belief that this is an even more valuable load for the central station than electric cooking:

Water Heating

"The question of heating water electrically, and particularly in connection with electric range installations, is still characterized by a wide divergence of opinion among central station men. There is, however, a decided trend in the direction of placing the water-heating business, properly handled, on a par with the electric cooking business. From the standpoint of value to the central station, a combination of the two is considered ideal, and, in fact, opinions have been expressed that the water-heating business alone (always assuming that it is properly handled) is even more valuable to the central station than the cooking business alone when considered from a standpoint of the sales effort needed, annual income per kilowatt and the resultant load characteristics.

"The vital problem lies, of course, in keeping the water-heating load off the range peaks. Two different methods of obtaining this result have been developed: First, placing the heater on a double-throw switch with the range; and, second, employing the use of a thermally-controlled 'step-type' heater operating directly on the line. This latter type of heater is finding greater favor recently, and it is particularly suited for working in parallel with a solar heater or the ordinary water-back installed in a furnace or fireplace.

"The two most important faults of the ordinary immersion or circulation type heater when installed on a double-throw switch with the range are overheating or underheating, due to abnormal or subnormal use of the range equipment by the housewife. These faults are completely overcome by the thermally-controlled heater, and, provided the load characteristics are such that the large water-heating demands will not coincide with the demands of the range, the thermally-controlled heater will approach nearer to the ideal automatic electric kitchen, toward which we are striving, though due consideration must be given to the larger radiation losses when this type is used.

"The question as to the use of the flat or meter water-heating rate is still an open one, and must be settled by each company in a way that will best fit its operating conditions.

"When the water heater is placed on a meter rate it is very important to the consumer and ultimately to the central stations that every possible method of economizing in the use of electric energy be used.

"The investigation and application of electric water heating has lagged behind that of electric cooking.

"The relation of storage capacity to the rate of use of water in the various classes of service to which electric water heating may be successfully applied and also the relation of storage to the kilowatt rating, are of great importance, and probably more real advance in the solution of these problems has been noted than in any other phase of electric water-heating progress.

"The installation of spring faucets, lagging, and a complete survey of both the plumbing installation and the habits of the various classes of domestic and commercial consumers, must be made and allowed for in order to ensure satisfactory service. This survey is particularly essential when the installation of a thermally-controlled heater on a meter basis is contemplated, as a very thorough study must be made in order to ensure the resultant load characteristics which will enable the central station to grant the service the low rate which is necessary in order to make electric water heating universally practicable to the consumer and at the same time profitable to the central station.

"It is the opinion of the committee that we are all more or less overlooking the importance of insulation in our study of the water-heating subject. Plant tests indicate that, while the manufacturers are giving us a number of very valuable heaters, we have very few convenient and economical methods of insulating boilers and piping. We believe that from now on more attention should be given to this phase of the subject. If more of the losses can be eliminated it will go a long way toward solving the problem."

Deterioration in Suspension-Type Insulators

In a recent paper presented before the American Institute of Electrical Engineers by J. A. Brundige the author discusses the causes for the rapid deterioration encountered in suspension type insulators touching upon the two leading hypotheses, namely, porosity and mechanical cracking through expansion effects. Mr. Brundige states that the engineers of the company with which he associated in investigating this problem from an operating standpoint have arrived at the belief that expansion effects are causing the major part of insulator deterioration. The conclusions of this paper are summed up as follows:

Conclusion

1. The conditions existing inside the metal caps are sufficient to explain, through temperature expansion alone, much of the trouble experienced. Expansion occurring in the cement because of moisture absorption is of an even more serious nature.

2. No evidence of importance is at hand showing that electrical stresses have caused the trouble under discussion.

3. Except for bad cases of underfiring, which are generally easily detected, losses of insulators in service do not bear any apparent relation to the degree of firing.

4. So far as observed, deterioration takes place quickly, such as would be expected during the formation of cracks. On the other hand, slightly porous ware absorbs moisture only very slowly and were porosity the predominating cause for failure, large numbers of units would undoubtedly have been discovered in the intermediate resistance stages.

5. Cracks of more or less long standing have been iden-

tified in a majority of cases where it has been possible to carry on post mortem examinations on defective insulator units.

6. The relatively good showing made over long periods by pin type insulators having cemented parts and by Hewlett units, none of which represent as high development of the porcelain manufacturer's art as some of the later suspension insulators, would indicate that porosity is not the factor of most immediate concern.

It is to be borne in mind, however, that after losses from expansion effects have been more or less completely eliminated, porosity in porcelain may remain as a problem of considerable importance, and that the work done in this direction by investigators will become increasingly valuable, unless perhaps a better material for insulators will then be available. Progress in overcoming expansion will doubtless include, as one of the steps, the elimination of Portland cement from the designs, and this incidentally will be of aid in simplifying the problems arising from porosity.

Mr. W. D. Peaslee has read an interesting paper on the insulation situation, in which he dwelt on the rapid deterioration of porcelain insulators that have passed the necessary tests—even when the insulators have not been in use. The results of his investigations appear to show that the following four factors are of predominant importance in this connection:

1. Mechanical stresses due to temperature changes necessarily resulting from the different coefficients of cubical expansion of the metal, cement, and porcelain; mechanical stresses due to the expansion of moisture in the cement on freezing and the changes in volume of cement with different moisture contents; and mechanical stresses due to improper firing and cooling of the porcelain.

2. Dielectric flux concentrations due to improper design of insulator shapes and defects in the porcelain. This can be remedied, but its general effect is, as has been shown, to permit the stressing of the porcelain to very high values by means of transients, which, like the poor, are always with us.

3. Dielectric flux concentration due to the fact that the porcelain is inevitably made of two or more materials of widely different physical properties, one isotropic and the others anisotropic in character as strikingly shown by microphotographs.

4. Mechanical stresses due to the differences in coefficients of expansion of the constituents of the porcelain acting to establish a separation surface between the crystals.

On the supposition that these four factors are the predominant ones in causing insulator depreciation the author lays out the requirements of an insulator that will avoid them, as follows:

1. A cement must be developed that will be elastic enough to take up the necessary changes due to expansion and contraction of the insulator parts under temperature changes. Condensite and other compounds have been tried in this, but so far as the writer knows, no positive results have been obtained that are as yet of commercial value.

2. Improve the design of the insulator to avoid flux concentrations and the placing of dielectric of different permittivities in series and improve the workmanship to avoid defects.

3. Make the insulator from an amorphorous, non-crystalline substance, containing only one constituent, or only those of the same electrical and temperature characteristics.

Summing up his investigations, the author concludes that a study of the growing mass of data on deterioration forces upon our attention the following insulator situation:

1. The porcelain insulator as commercially available today is not a success; it is deteriorating too rapidly, both in and out of use, and the gathered evidence points to certain inherent features of manufacture and composition that are responsible in large part for this unreasonable deterioration.

2. The design features may be overcome by a correct appreciation of the mechanism of breakdown and the application of correct principles of dielectric flux distribution.

3. It has been found possible to make and manufacture fused quartz on a laboratory scale, and indications are that it can be done on a commercial scale for a permissible price, and it is hoped that the development of this and other studies now being made by many engineers may lead to a lessening of the enormous cost of the present insulator depreciation encountered by the operating companies.

Activities of Ontario Joint Committee

The Joint Committee of Technical Organizations, Ontario branch, have just mailed letters to the technical men of the province, giving information on a number of matters which have been engaging the attention of the committee. One of the enclosures treats in a general way of the activities of this organization and its relations with certain governmental and military bodies. Another enclosure describes the work that has been done towards organized practical instruction for the returned soldiers; in this connection a form is enclosed to Toronto members asking for volunteers who will give part of their time to interviewing and conversing with soldiers with a view to determining what particular work they are best fitted for. A third enclosure refers to the return of the questionnaires.

As the information contained in these letters is of general interest to many of our readers who may not be on the calling list of the Joint Committee, some of them are printed below:

Letter re Aiding Returned Soldiers

"The Joint Committee, after consultation with the Soldiers' Aid Commission, has worked out a plan whereby the technical man can be of great assistance to the returned soldier. This plan will make it possible for the man who can spare an hour or so a week to assist. Is not this the opportunity you have been waiting for?

"A number of returned men are incapacitated in a manner that will prevent them from going back to their former jobs. They will have to be trained for new ones, preferably using their former experience and knowledge as a foundation. You have the technical and practical knowledge and could assist in the training of these men. Would you be willing to have a conversation with some returned soldiers, giving them an idea of certain phases of your work and find out from your conversation what class of work they could best be fitted into.

"This type of assistance would be invaluable and is urgently needed. Please fill in the form attached and return at once."

Letter re Questionnaire*

"As you may be aware, the Honorary Advisory Council for Scientific and Industrial Reasearch in Canada, who were appointed in November last, are desirous of distributing Questionnaires throughout the Dominion. The object is to obtain an inventory of the existing research equipment and also the needs of those engaged in the industries of the country. This object will be attained if the Questionnaires are accurately completed by those to whom they are sent.

"Experience in the States in connection with somewhat similar work showed that difficulties were encountered, which were only swept aside with the co-operation of the technical men acting through their organizations.

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* This letter goes to members outside of the city of Toronto and the Ottawa district.

"The Advisory Council therefore decided to profit by this experience and approach the different organizations in the Dominion.

"To cut a long story short, your Joint Committee were asked to take care of the collection of the Questionnaire in the Province of Ontario. Subsequently, by arrangement, a section of the province—known as the Ottawa district—was handed over to a Joint Committee formed at Ottawa for the purpose.

"Having explained the whole matter briefly I now come to the main point, viz.:—

"Volunteers are wanted to interview manufacturers and explain the object of the Questionnaires and see that they are filled in and returned to the Advisory Council.

"What will you do to help in the work?

"Please detach the attached form and mail right away.

"In your immediate vicinity there will doubtless be manufacturers to be canvassed. If so, are you prepared to co-operate in the work?

"It is of the utmost importance to the future development of our country. Need more be said?

"We think not.

"Will you prove it?"

Voluntary Aid to Returned Soldiers

"For some months past we have been endeavoring to find a way whereby the members of the technical organizations can be of assistance to the returned soldiers. We have been able to reach a working basis with the vocational officers of the Soldiers' Aid Commission of Ontario and the Military Hospitals Commission, so that the returned soldier who needs special training in some technical work will receive tutoring by a member of one of the Technical organizations while he is convalescent, and, if necessary, pass through a form of apprenticeship in an industry that he is to make his life work. This arrangement has been finally decided upon as we find it is in this capacity that the engineer and technical man can be of most assistance.

"The final plans have been definitely made for the city of Toronto. We would suggest that in the other locations in the Province, each technical man find out what is the condition of the returned soldier question in his own location and see what can be done to solve it. If we can be of any assistance kindly put us in touch with the situation and we will do all in our power.

"The Soldiers' Aid Commission of Ontario, is, at the present time, seeking vocational teachers to man the various training depots for the returned wounded soldiers. If any technical men feel that they can give up all their time and take a permanent position with the Soldiers' Aid Commission along the line of vocational training, kindly get in touch with this office immediately; or if the technical men know of any good foremen who would be of assistance as vocational teachers, kindly send in their names.

"The 'returned soldier' question is one that is of the utmost importance to the welfare of Canada, and it is certainly the duty of all technical men to assist to the best of their ability in the solution of this problem."

The Amended By-laws

A number of minor changes have been made in the by-laws, but undoubtedly the most important is that referring to the formation of branch or local joint committees at various points throughout the province. The exact wording of the section which covers this item is as follows:

> (4) Branch or Local Joint Committees may from time to time be organized throughout the Province of Ontario in different centres where there are members of one or more of the different organizations associated with the Joint Committee. Branch or Local Joint Committees so constituted, shall on application duly authorized by a majority vote of the members, be entitled to representation on the Joint Committee, subject to the approval of a two-thirds majority of the Joint Committee. Such representation shall, however, be proportionate to the number of registered members in the District concerned. Each District shall be as outlined by the Joint Committee from time to time. "Registered members" shall, for the purpose of these By-laws, be interpreted as those members who have returned their census or registration cards to the Joint Committee during the year in which the Local Joint Committee is formed.

The work of the Joint Committees in the province of Ontario is going forward rapidly. Mr. W. E. Segsworth has taken the chairmanship of the Executive and is giving practically his whole time to the work. The prospects are that the problems with which the Committee will be confronted in the near future will demand the assistance of a very large number of voluntary workers. For this work there can be no doubt the technical men of the Dominion hold themselves in readiness.

The Electric Club of Toronto Adjourns During Summer

The members of The Electric Club of Toronto have decided to adjourn during the summer months, and held their final luncheon for the season on Friday, May 18. Although no set program had been provided the attendance was one of the largest of the year, particular interest centering round the "greater production" campaign which the Club has undertaken. In this connection satisfactory progress was reported.

An interesting feature of this last meeting was a presentation to Mr. Groome, secretary of the Club, as a "mark of appreciation" on the part of the members, of the successful manner in which he had maintained interest in the undertaking throughout the year. The procuring of prominent speakers for the weekly luncheons has been one of the most important contributions to the success of the Club and it is probably quite safe to say that no local club has listened to a more interesting or clever programme of addresses than has The Electric Club of Toronto. This fact has been due to the untiring energy of the secretary, assisted by the co-operation of the members, who at all times have given freely of their time and experience to make the Club a success.

During the summer the Club will be busy on their little "farm" out on Christie Street, in preparation for a renewal of luncheon activities in the early autumn.

Immigration and the War

From an oratorical viewpoint the members of the Montreal Electrical Luncheon have not heard a finer speech than that delivered by Mr. M. J. Gorman, of the United States Immigration Service, at the luncheon on May 16. Mr. Gorman spoke on "Immigration and the War." There was no subject, he said, which could better occupy the attention of patriotic men than that of immigration. It contained all the fundamental elements of a science, but little attention was paid to it, notwithstanding that it was the foundation of Canada and the United States as nations. Mr. Gorman briefly traced the history of immigration, pointing out that the founders of Canada and the United States had sought these shores with the object of securing liberty of thought and action.

Hydro Possibilities of British Columbia

Development Opportunities Outlined, With Special Reference to Vancouver District Needs and Present Service.

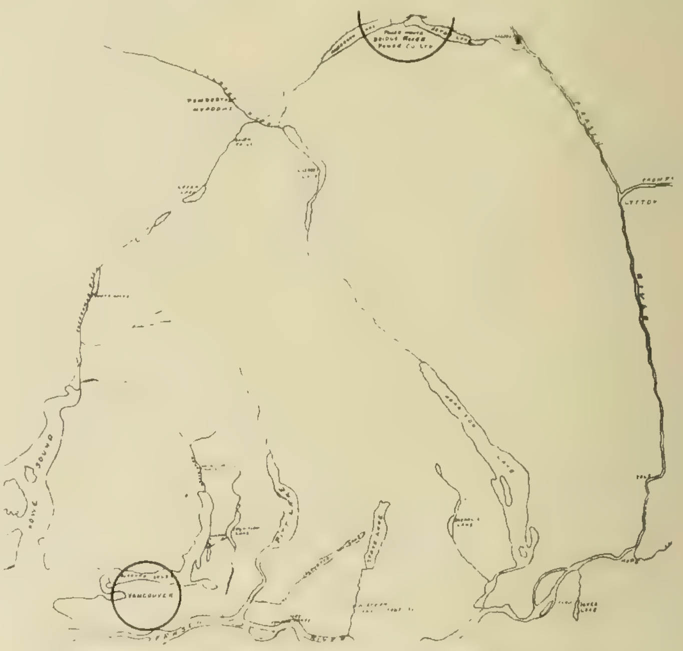
By W. R. Bonnycastle

Ask the average citizen of Vancouver about water power and he will tell you that there are millions of horse power running to waste within a few miles of Vancouver, and then, very likely, he will jump to the millions of tons of iron, coal, copper, and other minerals, and from that to the great areas of timber land, etc.—the great natural resources of the province—and he will talk as if the province were all ready to supply the world with everything required in these lines. Then he will go about his business and forget all about the subject until someone gets him started again.

The industries we so greatly require for this province will be a long time coming if our efforts towards getting them started are limited to glowing rhetorical periods as to our resources. There are millions of horse power running to waste in the streams of British Columbia, but there are not nearly so many millions as there are popularly supposed to be around Vancouver, and a good deal of the power that actually exists cannot be delivered at a low enough cost per horse power to make it of any use to the province at the present time. The people of British Columbia, as well as the majority of Eastern people, evidently think that there is so much water power here that no attention need be paid to its conservation, and that is where they made a great mistake. Our own people, as well as our visitors from outside the province, do their sightseeing in the summer time, and from boat or train see a number of rushing rivers and high waterfalls pouring down from snow-capped mountains. In imagination they see a mighty power plant generating electrical energy for transmission to distant cities for tremendous industrial enterprises. These people would be surprised if they saw the same rivers and waterfalls a few months later—either late in the summer, when the snow had all melted from off the mountains and there was little water to supply the streams, or still later, during the winter, when the streams are ice-bound and in many cases entirely cease to flow.

A large proportion of the streams of the province have a greatly reduced flow for several months in the late summer, and again for three or four months during the coldest period of the winter. A stream that can only develop power for six months of the year is not of much use for industrial purposes unless storage is available. By storage we mean the holding back or collecting of the surplus water of the spring and summer months, so that it may be released as required to maintain a steady flow during the low water periods of the fall and winter. If this necessary storage is available we may, by the use of dams, so regulate the stream flow that it may be possible to develop a large amount of power throughout the year. Unfortunately, however, there are many streams where this regulation is not possible, no storage being available, and there are other streams upon which storage might be found but at a prohibitive cost. Streams of this nature, at the present day at least, cannot be developed to any great extent. There are other streams, such as the Fraser River, where the engineering features would be too difficult for economic construction, at least until water power is of considerable more value than at the present time. As water power becomes of more value, undoubtedly some of the developments at present not economically possible will be utilized, but for the present plans must be restricted to those developments which are capable of being constructed at a very low cost per horse power.

The troubles of water power development, especially in the West, have been largely due to amateur promotion and wasteful engineering, but I believe the power developments of the future will be more carefully handled and the same business methods used as are necessary to the success of any other business enterprise. The usual procedure in this kind of undertaking has been for someone to acquire the water rights and then to try to induce financiers to finance the proposition. The owner of the water rights wants to become rich at one stroke, and the financiers must have their bit, and usually a good, big bit at that, consequently the development is overloaded with costs from the start. It often means that a development that has cost $5,000,000 for the actual construction work will have to pay interest on $10,000,000, and this has to be paid by the consumers. Power that might be had for $10 per h.p. per annum but for promotion and financing charges will cost the consumer $20 per h.p. year. With government or municipal ownership, on the other hand, the enterprise is not for direct profit, but for the good of the people, and to obtain revenues indirectly by attracting industries and an increased population. The government or municipality should have no difficulty in financing at a saving of 2 or 3 per cent. over private enterprise, and would start their development practically free of overhead charges.



Showing relative location of Vancouver and Bridge River power.

Electrical energy is one of the few commodities that has gone down in price, while the cost of nearly everything else that enters into our life has gone up. To-day a quarter of the total industrial power utilized in the United States is electrical, and competent authorities believe that fully 85 per cent. of the total industrial power can eventually be economically taken over by central electric power stations. This means an addition of more than ten million horse power with the present volume of industry and an expenditure in central station construction of $1,875,000,000 for the production of that amount of current. Mr. Vanderlip, probably the leading American banker, says: "Four hundred million a year—eight million a week—of fresh capital can profitably be used in the development of the whole broad field of the electrical industry in the United States during the next five years." The development, generation, and distribution of electrical energy is a business for the best management and engineering talent obtainable, and this is becoming more necessary each day as electrical energy becomes more important to our existence, both in our business and in our homes.

There comes a time in practically every large business when financial difficulty places the management in the position that this province is in to-day. The cry is "retrench." The successful business man looks around for a means of increasing his revenues instead of curtailing his operations. Then he goes more deeply in debt in order to expand and grow great while his competitors are standing still or going backward. That is the proposition before the province to-day. Are you going to stand still and make no bid for the great industrial activity that will follow the war, or are you going to go more deeply into debt in order to grow great quickly when the time comes? You can lighten your load of taxes by increasing your revenues from your natural resources, and you can increase your revenues from taxes by attracting great industries by the bait of cheap power.

At Niagara Falls there are available large quantities of power which are for sale to large power consumers at the rate of from $18 to $20 per horse power year. Niagara Falls is an ideal location for a great many electro-chemical and metallurgical industries, as it is the centre of a great market for the products of these industries, and has cheap transportation in all directions. On the Canadian side about 400,000 horse power is now in operation, and new developments are in progress. Clouds, however, are beginning to appear on the horizon for the large power-using industries. In spite of the large amount of power available, it is evident that in the near future all of this power will be required for general distribution throughout the surrounding districts, and the rates for private consumers are being raised as fast as the present contracts expire. It is evident that other and cheaper power must be found for future extensions of the large industries at present in operation, and for the new industries that will be brought into existence by recent electro-chemical and metallurgical discoveries.

Cheap Transportation to Foreign Markets

Vancouver, by virtue of its location on the Pacific Coast, has the possibilities of cheap transportation to foreign markets, and may even have this advantage over cities of the Middle West in supplying Eastern markets if proper shipping facilities are provided, and by the addition of a plentiful supply of cheap power might attract industries like a magnet attracts iron, but Vancouver must wake up or the cities of the Middle West will get the cream of the large power-using industries at present looking for favorable locations. Winnipeg, Edmonton, and Calgary are wide-awake, and are making great strides in the power situation.

The present Coast operating companies claim that they are offering as cheap a rate for large blocks of power as any city in Canada. This statement, even if correct, does not go far enough. It is possible to offer cheaper power than any other city by a government or municipal-owned system. The operating companies claim that they own other development sites where they can develop large quantities of power when necessary. They control no sites comparable with the one at present under option to the city; also, to control sites is not enough. We must have these developments advanced to such a stage that we can deliver the power within a reasonable time, as prospective industries will not wait two or three years for a supply of power.

The use of electric energy for producing furnace heat has revolutionized many modern industries. The field which it has created in the development of electro-chemical and metallurgical processes has great possibilities. Not only does the electric furnace afford opportunities for improving and widening these industries, but its use requires large quantities of electric power, the development of which produces a market for energy that might otherwise lie dormant or go to waste. Furthermore, it improves the load factor and diversity of large central station loads, and otherwise tends to foster greater economic wealth. The application of the electric furnace has made it possible to manufacture a number of substances that would otherwise not be available for commercial purposes if combustion methods were the sole means of production. None other than electric furnace methods have ever been successfully employed in the manufacture of such well-known substances as carborundum, aluminum, and calcium carbide. Immense industries have been built up and great quantities of power employed for their production. There are many other processes that may be performed only with the electric furnace, but the extensive application of which are limited by the cost of production.

Nitrogen for Fertilizers

There is little doubt but that more of the supply of nitrogen required for soil fertilization will be drawn from the air by electric furnace apparatus as the present rapidly depleting natural nitrate deposits become exhausted. Several plants located where electric energy is cheaply produced now manufacture great quantities of nitric acid and nitrate, and consume enormous amounts of power. The electric furnace can create temperatures greatly in excess of those otherwise available, and with present apparatus temperatures as high as 6,500 degrees Fahrenheit may be obtained. The exclusion of objectionable furnace gases makes it possible to perform many new operations, and the smelting of various metallic ores that formerly could not be handled satisfactorily or economically has been made possible. The world feeds itself on the first six inches of earth. If we want it to keep on feeding us we must fertilize it, and the demand for fertilizer must continue to increase.

The Norwegian Nitrogen Company, previous to the outbreak of war, had 260,000 h.p. devoted exclusively to the fixation of atmospheric nitrogen, and 280,000 h.p. more projected, a portion of which has likely been constructed under the pressing demand of Germany for nitrate. Very cheap power is essential to this industry, but we can produce the required power in this province very nearly, if not quite, as cheaply as it is produced in Norway, if we go at it in the right way. The Ontario Hydro-Electric Commission has had a phenomenal success, and other provinces and cities are preparing to follow in its footsteps. Is there any reason why Vancouver should not do the same? Winnipeg is wide-awake, and has made a thorough investigation of its power possibilities. That city has expended $4,000,000 up to the present time, and is steadily increasing that amount.

Investigation at Winnipeg has shown that it is possible to develop 400,000 h.p. within 75 miles of the city, and at the present rate of increase in the use of electric energy all this power will be required within forty years. As the rate of increase is expected to grow more rapidly in the future than at present, it is possible that all this power may be required within twenty years. To develop this 400,000 h.p. Winnipeg must construct and operate nine separate power developments, at an average cost at the power house of $85 per horse power. Vancouver has a great advantage over Winnipeg in this respect, as we can obtain 400,000 h.p. from one power development, costing $45 per h.p. at the power house. The cost of power delivered at a receiving station at Winnipeg would approximately be $100 per h.p., while the cost at Vancouver, under the same conditions, would be $75 per h.p. For the first 60,000 h.p. developed the difference in cost would be about $15 per h.p., but as the capacity of the systems were increased the differences in the cost would become greater, until at a development of 200,000 h.p. the advantage in favor of Vancouver would be approximately $35 per h.p. We would thus have a considerably smaller construction cost, and the interest maintenance and operating cost of one large station would also be much less than those same items for Winnipeg's nine stations. In order to develop the cheapest power on this continent we must confine ourselves to as few separate plants as possible. The policy of the electrical business is to consolidate.

There are a number of small power developments within a hundred miles of Vancouver, and some of them might be developed up to their capacity at a slightly less cost per horse power than the same amount of power from the large development referred to, but the advantage would only be temporary, and when sixty to a hundred thousand horse power is required, the large single development will have the advantage, and this advantage will grow greater as more and more power is needed. It would be folly to develop a power site of small capacity, as the first large industry would wipe out the surplus power and require the construction of additional plants, and the cost of construction of these plants would increase, as naturally the cheaper sites would be developed first, so that instead of growing cheaper our power would grow more expensive. A single false step at the beginning may destroy the great advantage the district has over other districts that require a number of separate developments.

City Should Own Power Site

The first step necessary for Vancouver to enter into the development and distribution of electrical energy is to obtain an amendment to its charter permitting the city to acquire a power site, and I would advise the people to take some interest in this matter and see that this amendment is obtained. The future of the city of Vancouver may depend largely on that charter amendment, and again I advise the people of this city to enquire closely into what is going on. Vancouver is a very dirty city, especially in the winter time, when every furnace is discharging great quantities of soot. With cheap electrical energy we could do away with this soot nuisance almost entirely, as the electric furnace and range is far superior to the present coal and gas apparatus, but to make the cost no more than at present we must have a greatly reduced rate for electric energy.

Vancouver is lagging behind not only the other cities of Canada, but also the other cities of the Pacific Coast—Prince Rupert, Seattle, San Francisco, and Los Angeles, all of which are either operating or preparing to operate municipal systems for the distribution of electrical energy. The high cost of power is retarding the progress of the province in mining, industrial enterprises, and in agriculture. More people would go on the land if they could have more of the comforts of life, such as light, power, and rapid transportation.

There are great areas in the dry belt that only require cheap power to irrigate. If the government desires to develop these districts, cheap power is the first essential, giving to the settler many comforts as well as the necessities in the way of farming machinery and rapid transportation for both himself and his farm produce. Under these conditions the districts would settle up quickly and the production of foodstuff in the province be greatly increased. The development of power systems throughout the province would provide employment for a great many of our returning soldiers, and ultimately most of these men, who at present have no inclination for the land, would become farmers. That has been the experience of other sections of this country—that many of the men employed on development work in a good farming country have become farmers themselves. The good of the province demands the development of its resources, and I can see no reason for hesitation in starting this development.

So far as my knowledge goes, there are not more than two sites available for the city of Vancouver where the necessary amount of information has been obtained to allow the city to go ahead with immediate development. The control of water rights is on the same footing as the control of timber, mines, and other resources, and should have the same privileges. The lack of interest being shown by the people of Vancouver with regard to the preservation of their water supply and to the obtaining of a cheap supply of electric energy is surprising, to say the least, and very disheartening to some who are endeavoring to develop the growth of the district.

The capacity of power plants is being increased wherever possible, and from reports published of 55 per cent. of the rated capacity of central stations of the United States the earnings for January, 1917, was $41,000,000. This is an increase in earning over January, 1916, of 143 per cent., and an increased output of 27.7 per cent., or over 2,000,000,000 kw. hour increase for 1916 over 1915. Why should the people of Vancouver district or the Province of British Columbia not have the advantage of the great profits to be realized from this natural resourse, instead of allowing it to go to private interests?

It then remains to be seen if the Government of British Columbia will take steps to control this important resource, but if it does it is to be hoped that some energy will be shown towards active development all over the province. It will take time to investigate the water resources, and these investigations are necessary before an intelligent plan of development can be formed, but the water powers are just as important as the timber, mines, and other resources, and very little is being done to gather the necessary data.

The various uses for electric energy on the farm, in the woods, and at the mines are rapidly increasing, and in time a network of wire will extend over a good portion of the province. On the farms electricity is replacing the horse, and is used for lighting and household purposes, water supply for house and barn, pumping water for irrigation, plowing, threshing, trucking, and in the dairy. The various apparatus run by electric power includes hay pressers, incubators, alfalfa mills, sheep shearers, cider mills, apple sorters, spraying machines, etc. Electric logging is fast coming to the front, and in many cases is cheaper than any other form of power, besides doing away with the risk of fire. Electric power for the mining industries is growing in importance every day. Besides the general uses for lighting and the operation of mine and mill apparatus, its use is rapidly extending to the treatment of ores, and in the future large quantities of electric energy will be required for the reduction of iron, copper, zinc, and other ores.

Half Million at Bridge River

The great power of the province is known as the Bridge River development, and is 138 miles from Vancouver. The development consists in driving a tunnel through a ridge of mountains which separates Seton Lake and Bridge River. The tunnel would be about the same length as between Lakes Buntzen and Coquitlam, and would give an operating head of 1,400 feet, so that the same sized tunnel as at Coquitlam would give three and one-half times as much power at the Bridge River. The average flow of Bridge River is 4,000 cubic feet per second, which, if storage facilities were provided, would give 500,000 h.p. of electrical energy at the power house on Seton Lake. The cost of development at the power house would be $45 per h.p., and the cost per horse power delivered at Vancouver would be from $70 to $90 per h.p., depending on the amount of energy delivered. The transmission lines from this development would run through districts rich in timber and minerals, and would supply the the farming district with cheap power, but power could be cheaply transmitted as far north as Prince George, east to Revelstoke and south to the boundary country, thus supplying a large portion of the province from the one development.

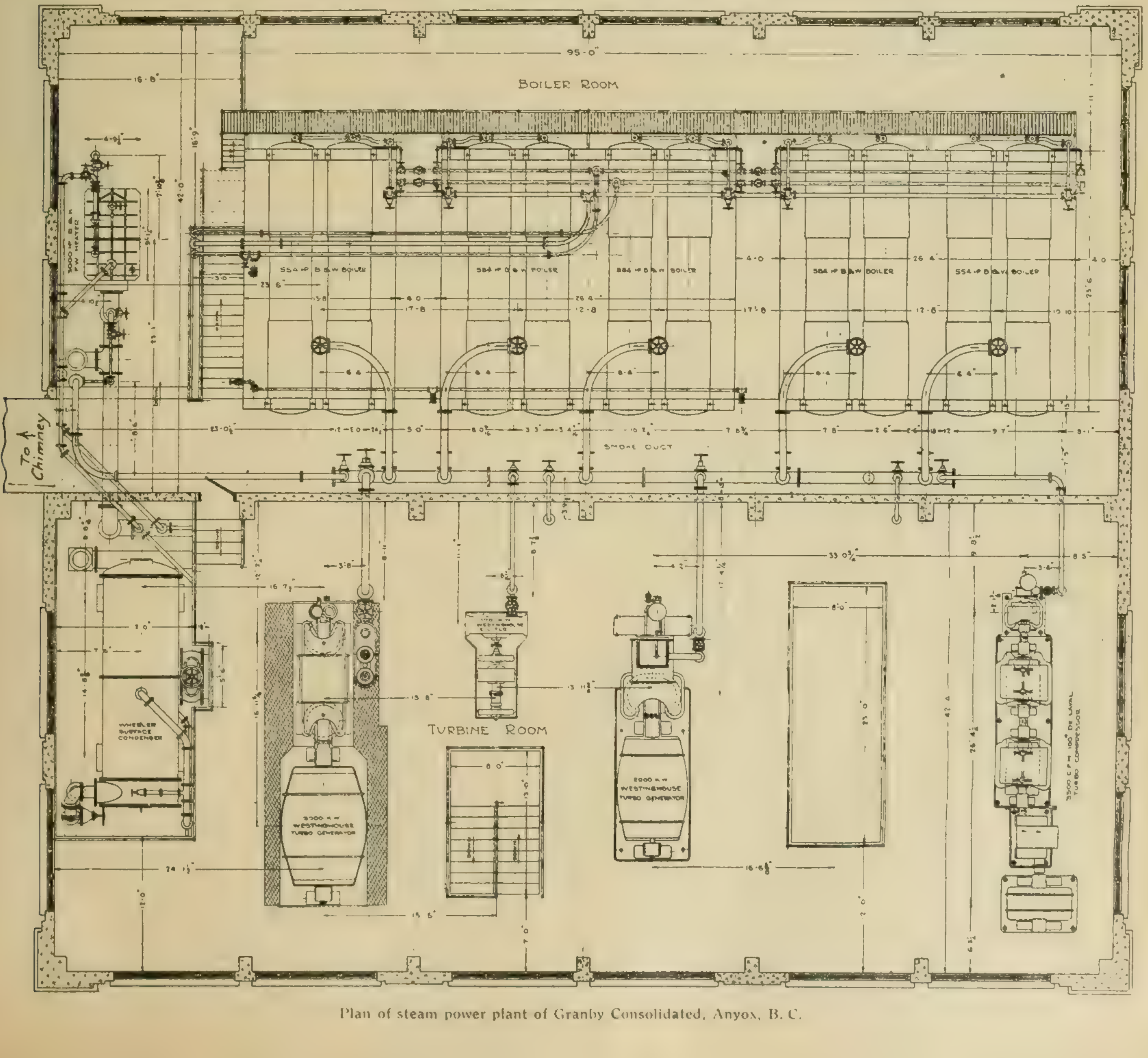
Steam Power Plant of Granby Consolidated Mining, Smelting, and Power Co., Ltd., at Anyox, B.C.

The Granby Consolidated Mining, Smelting, and Power Company, Ltd., have recently constructed at Anyox, B.C., an auxiliary steam power plant, at a cost of nearly $500,000. The power house is a reinforced concrete structure, approximately 100 ft. x 90 ft. x 37 ft. high, in which are installed five 550 h.p. water tube boilers, designed for a working pressure of 200 pounds and 150 degrees superheat. These boilers are served by a continuous brick smoke duct, entering the base of a Custodis radial brick chimney 10 feet in diameter and 150 feet high.

In the boiler room is installed a 3,000 h.p. Blake & Knowles open feed water heater, two Worthington oil-burning sets, and two De Laval centrifugal steam turbine-driven boiler feed pumps, each having a normal capacity sufficient to take care of the entire plant.

In the turbine room is installed a 3,000 kw. Westinghouse turbine-driven, 3-phase, 60-cycle, 2,200-volt alternator, the turbine exhausting to a C. H. Wheeler surface condenser; one 2,000 kw. Westinghouse turbine-driven generator, the turbine exhausting to a Westinghouse Le Blanc jet condenser; one 100 kw. Westinghouse turbine-driven exciter exhausting to a feed water heater. In the turbine room is also installed a 3,500 cubic foot, 100 pounds pressure, De Laval centrifugal compressor, consisting of fourteen stages, and arranged to be driven at the one end from an 800 h.p. De Laval turbine without reduction gears, and at the opposite end by an 800 h.p. Westinghouse 2,200-volt induction motor operating through De Laval reduction gears. This unit is the first high-pressure centrifugal compressor to be installed in Western Canada, and it is a particularly interesting piece of apparatus apart from the fact that it is arranged for two forms of drive, one to be used when the steam plant is in operation and the other when the water power is adequate to furnish current for the electric motor, which will be during the summer months.

The 800 h.p. De Laval turbine is arranged to exhaust to a Schutte and Koerting jet condenser. The entire turbine room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To Chimney
TURBINE ROOM
WHEELER SURFACE CONDENSER
3000 K W WESTINGHOUSE TURBO GENERATOR
100 K W WESTINGHOUSE EXCITER
2000 K W WESTINGHOUSE TURBO GENERATOR
3500 C F M 100# DE LAVAL TURBO COMPRESSOR

Plan of steam power plant of Granby Consolidated, Anyox, B. C.

floor is served by a 15 ton hand-operated travelling crane. Circulating water for condensing purposes is supplied by two 12 inch De Laval centrifugal pumps, each directly connected to a 125 h.p. Westinghouse motor. Each pump has a capacity of 1,000 gallons per minute against a total head of 70 feet, and either unit is capable of supplying the full requirements of the plant.

The high-pressure steam piping has all been designed for a pressure of 230 pounds and 150 degrees superheat, and the main steam header is of cast steel, and a particularly good piece of work. All steam piping was supplied by Crane Company, Vancouver. The plant is intended to serve the operation of the company during the periods of low water, and it is believed will be in operation for about six months of the year.

In connection with the plant is a fuel oil storage system, consisting of a steel storage tank 90 feet in diameter by 30 feet high, having a normal capacity of 35,000 barrels. Oil is received at the company's dock and pumped through about 1,400 feet of 12-inch diameter pipe to this tank. In the tank is installed a heating coil of special design. Adjacent to the tank is a small concrete pump house, in which is installed a vertical boiler, which supplies steam to the heating coil, and an electrically-driven rotary oil pump delivers oil from the tank through about 900 feet of 6-inch line to an auxiliary tank buried underground at the power house.

The plant was erected in a comparatively short space of time, as the company did not proceed with the construction until June, 1916. The design of the plant was under the direction of Mr. F. M. Sylvester, vice-president and managing director of the Granby Consolidated Mining, Smelting, and Power Company, and the work has been carried out by the Taylor Engineering Company, consulting construction engineers, Vancouver, B.C.

The Evolution of the Electrical Process of Manufacturing Steel (Concluded)

By Mr. Geo. M. Berry*

Part III.—Considerations as to Type

With many of the types of these furnaces now in use there has been, as we have seen, the effort to introduce heat directly into the metal of the bath by passing the current directly through it. At first thought this would seem to be a good thing, and the arrangement whereby heat can be introduced in the bath with control as to its intensity from below, as well as from the top, would certainly seem to have advantages in the early stages of the heat in helping to bring the bath up to reaction temperature, and especially in lessening the time in cold melting.

The time when we looked upon the current of electricity itself as having any virtue in the refining process is, I think it is safe to say, passed. In addition to the added heating effect of the current passing from the bottom through the bath, one of the strong points of consideration is the circulation effect which is given to the metal.

While it is true that, so far as the author of this paper knows, there has been no thoroughly exhaustive investigation of this point, yet we do know that beyond a certain point the less agitation there is in the bath the better will be the product. The more violent the agitation in the finishing of the heat the less the tendency toward quietude of the metal in the moulds. This may be due to the presence of oxygen, nitrogen, or other elements, occluded or otherwise.

Aside from the killing or quieting effect on the steel—the elimination of gaseous content in which the time element plays so important a part—the work of refining is done by the slag in the plane of contact of the steel and the slag.

Parenthetically, let me say that from a metallurgical point of view, probably the strongest objection to the pure induction furnace type is that the heat is all applied to the metal, and that there is a relatively small amount of surface of the metal in contact with a relatively cold slag which, at its low temperature, is impotent to perform the necessary reactions of purification.

From our general understanding of the purifying reactions it is true that they take place more rapidly and more completely at the higher ranges of temperature obtainable in the slag rather than in the lower. Therefore, it would seem that by utilization of a refining process, like the Heroult, by which we can impart an intense heat under definite control to the zone of reaction, namely, the slag, and can make this heat intense enough to cause sufficient motion to the bath to produce homogeneous diffusion of the metal, bringing all parts of it in turn into intimate contact with the slag, at the same time avoiding the violent and undue motion of the metal (such as is caused by the arc through the metal) we will have arrived at an almost ideal condition in the application of the heating energy.

We may find a rough sort of parallelism in this consideration by likening the violent action of the current through the metal and the slag to the blowing of the air up through the charge in the Bessemer converter and by likening the hot blanket slag of the open hearth to the slag-arc-resistance of electric furnaces of this type.

It is not the author's purpose to in any way derogate any of the furnaces which are developed and are doing good work, yet he begs to call attention to these considerations and to suggest that the weight of evidence from the point of view of commercial adoption and practical attainment is very heavily in favor of furnaces of this type. More than half of the world's installations are, as we shall see, of the leading furnace of this type—the Heroult.

The Second Cycle in the Electric Furnace Era

We have pointed out that the new era in steel making—that of the electric furnace—began about with the twentieth century. We have now, at the close of fifteen short years, already come to the second cycle of development, if I may use the somewhat paradoxical terminology of a cycle within an era.

This grows out of a peculiar situation. All the countries at war have been obliged to produce under the highest possible pressure the maximum amounts of iron and steel to be used for war purposes that their conditions will permit, the larger part of such production being for the better grades of steel.

We can, perhaps, best understand this situation, which is the turning point into the second cycle of electric steel or its period of general commercial adoption by taking a very brief survey of the steel trades condition during the past year and a half. The mills of this country experienced the condition of passing from operation at about 35 per cent of capacity to operation under demands, for many lines, greater than ever experienced before in the history of the industry.

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*From address presented in connection with C.P.R. hydroelectric exhibit [illegible] Limited, of Montreal.

Parenthetically, it is worth while to note the source of the demand in the United States. The idea has been, perhaps, generally prevalent that this is due to war orders, and this is in a measure true because of stimulation by orders for some 50,000 freight cars, of which upwards of 20,000 went to the French and Russian Government; stimulation by orders for automobiles and motor trucks, and for shells, shrapnel and shrapnel cases for our allies. This condition was most noticeable during the second quarter of 1915, because war orders constituted then a larger percentage of the total than they have since.

It must be borne in mind that for many of the articles for which we have had excessively increased demand there has been a compensating falling off with others. Taking as illustration a few at random, as pointed out by some of the trade papers and comparing the export figures of the first nine months of 1913 with the first nine months of 1915 (at the time of writing this I did not happen to have available figures for the full year). We have agricultural implements, taken largely to Europe, decrease from $27,622,594 to $10,371,379, while breadstuffs show increase from $166,848,067 to $423,360,972; wheelbarrows, push-carts, etc., decrease from $598,648 to $232,391; the number of motorcycles increased from 3,459 to 11,859; wagons decreased from 16,980 to 5,949; motor trucks increased from 778 to 17,269; carriages decreased from 13,458 to 1,139; passenger automobiles increased from 20,175 to 31,036; cash registers decreased from 33,064 to 11,920; horseshoes increased from 950 tons to 14,000 tons; printing presses decreased from $2,031,774 to $1,065,529; metal working machinery increased from $11,980,778 to $30,844,199; steel bars (used in manufacture of shells) increased from 164,000 tons to 300,000 tons; structural iron and steel decreased from 309,000 tons to 169,000 tons.

Normal Growth

Further, a review of the production of iron and steel in this country will show that for several decades the production of iron is doubled about every ten years. Taking, therefore, the year 1907, with a production of pig iron of 27,000,000 tons, as compared with 1915, with a production of about 38,000,000 tons, a considerably smaller increase is found than would be expected, so that the present demand, which hequires more than the present capacity, may not be an abnormal one, but rather the result of a normal growth.

In addition to this, the fine steel industry in the United States has been, since the last of 1914, confronted with an unprecedented demand from two causes. One may be said to be a part of the natural normal growth, and grows out of the enormous increase in the use of the automobile, which could not exist as it is to-day except for the alloy steels which go into its vital parts. The bulk of this tonnage goes into uses other than for war purposes. The second cause of this abnormal demand for fine steel is the practically complete elimination of imported tool steels from the countries which, before the war, supplied, in the practical absence of protective tariff, so much of the tool steel consumed in the United States. We at once now have a cumulative shortage, for we not only have to meet our requirements of yesterday, but to this we have added the demand from our normal growth, and to this the further added demand from the absence of our normal importation. Under these conditions we would undoubtedly crowd our crucible melting installations to their full capacity and make new crucible melting installations, but, alas! where are our materials? Our pots are made of graphite and clay. Our graphites come from India and our clays from Germany. England is not disposed to permit the importation of graphite, and Germany cannot let us have any clay. True, we have a considerable variety of graphites from Alabama, New York, Pennsylvania, and Georgia, and some of the other states, from Canada, and Mexico. We have also a large amount of manufactured graphite. Of the clay, too, we have numerous varieties from various locations, but with neither these graphites nor clays have the crucible manufacturers been able as yet to make pots that are at all comparable with those made from the usual peace time sources. Neither are they able to make anything like a sufficient quantity, such as they are, to keep the crucible furnace capacity of yesterday in operation at this time. In many cases the pots have been so poor and the cost price so high that the melting cost for pit alone has been as high as 4c or 5c a pound.

The result of all this is to bring us, as I have said, at the close of only fifteen years, into the second distinct period of the use of electricity in this field, and there has been, through the past two years, and is at the present time, a wild rush for electric furnaces.

A good deal of this is legitimate replacement of crucible tonnage. Many, however, have bought electric furnaces apparently with the idea that all that is necessary to connect up and turn on the "juice," just as one would an electric toaster or vacuum cleaner. This, as we know, is far from the fact. This condition may, to a certain limited extent, be due to the propaganda of electric power companies seeking market for their power.

The rush for electric furnaces seems to be very generally in the air and the present danger, as I see it, is that the pendulum will swing too far and electric steel fall into a certain sort of ill-repute, due to the country being deluged with a mass of electric product, made under conditions where the skill and traditions of fine steel-making, or steel-making of any kind, do not attain.

If there are failures in some particular installations it will be for just the exact opposite of the reasons which have been stated as making possible in so short a time the tremendous advance in the development of the Heroult process. It will be because of making the attempt to make steel and particularly fine steels by men inexperienced in the art and untrained to the exacting requirements of producing high-grade product.

I have, however, great faith in the ingenuity, versatility, and capability of the men of to-day who are engaged in technical manufacturing problems in our own and in other countries. There can be no doubt that there will ultimately be maintained with electric steel in the future, as exists to-day, a standard of quality for the various demands of service unexcelled, if indeed equalled, by any other process.

We may state the development thus far as being such that we can make at will as pure iron as is desired and can then add to it whatever metals are desired as alloys in the finished product. Or, to state it another way, we are able to produce in the electric furnace any steel that we have ever been able to produce in the crucible (or by any other process), and many that, even under normal conditions, could not be produced profitably or as uniformly in the crucible at all, such as the low carbon alloy steels.

The problems now are rather those of working our general, and even yet rather crude, knowledge to more efficient practice. Some of these problems are in the utilization of our electrical energy, the development of refractories, and the relation of fluxes and temperatures to reactions and melting losses. In these and many other problems the call is for painstaking and thorough investigation and study of the details of these things which in the future may open up even more wonderful possibilities than those already attained.

Don't forget the C.E.A. Convention — Montreal, Ritz-Carlton, June 7 and 8.

The Water Powers on Western Rivers

Data Obtained by Commission of Conservation Show Power Possibilities of the Hayes and Saskatchewan Rivers

Hayes River

The Hayes River drains an area east of the Nelson River and empties into the Hudson Bay a few miles from the mouth of the Nelson.

The discharge of the Hayes River, metered on August 5, 1913, at a point four miles below "The Rock," was 3,265 cubic feet per second. The width at this point was 252 feet, the maximum depth seven feet, and the greatest mean velocity in any one section 3.45 feet per second.

"The Rock" is the lowest portage on the river, and between it and Swampy Lake, 35 miles upstream, the descent occurs in short rapids; these are not very steep but the current between them is strong.

The available theoretical horse-power given for two of the largest falls on this river is 6,350 each under a head of 35 ft. There are numerous other falls estimated at 1,500 h.p. and smaller.

Saskatchewan River

The North Saskatchewan and South Saskatchewan rivers, uniting at the forks, form the Saskatchewan River, which after traversing part of the province of Saskatchewan and Manitoba, empties into the north-western part of Lake Winnipeg.

On the main Saskatchewan River between Cedar Lake (Manitoba) and Lake Winnipeg, Grand Rapid occurs in a large bend where the river is about 1,300 feet wide. It affords good conditions for a development with a head of 80 feet. The estimated capacity is 41,000 h.p. Between the Red Rock and Grand Rapids, the river is from 600 to 900 feet wide. At two other points in this district estimated powers of 7,700 h.p. are listed. Four other falls situated on the main river in the province of Saskatchewan are rated respectively 10,000, 9,500, 2,700 and 1,900 h.p.

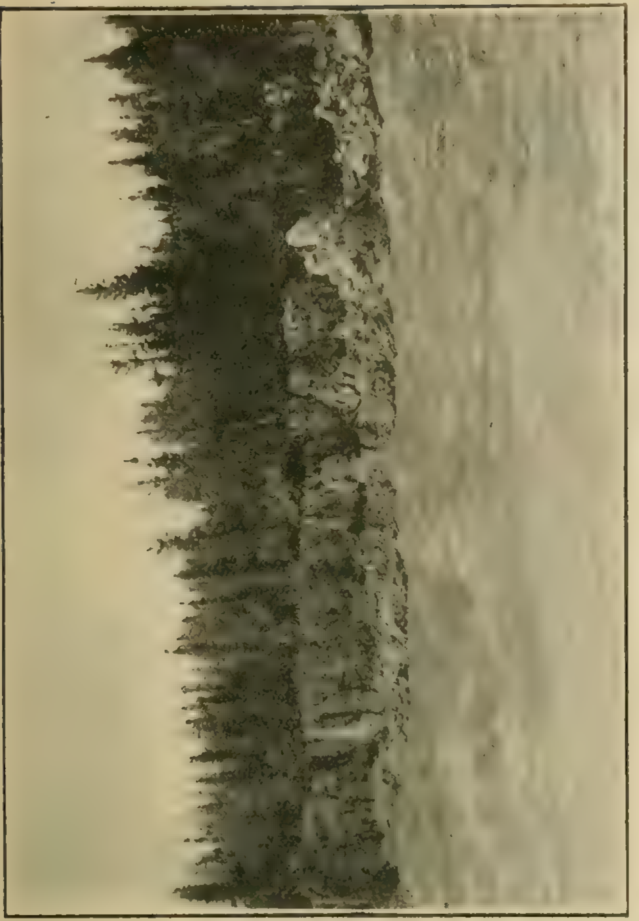
The main river, as already noted, is formed by the junction of the North Saskatchewan and South Saskatchewan, some 30 miles east of Prince Albert, Sask. In the immediate vicinity of the junction point there are four possible power sites on the north branch rated approximately at low water capacity of 3,000, 2,000, 2,000 and 3,000 h.p. The only other waterfall of any considerable importance on this river in the province of Saskatchewan is on the south branch, some 15 miles north from Saskatoon, where a 15-foot head is available and a minimum of 1,700 h.p. Some time ago considerable work was done on the construction of a dam for the development of this power for the city of Saskatoon, but the work is at least temporarily abandoned.

The north branch of the Saskatchewan River rises in the Rocky Mountains and traverses from west to east, therefore, the whole of the province of Alberta. There are a number of possible power sites, most of which are small. The largest is that known as Rocky Rapid, some 75 miles west of Edmonton, where, with regulated river flow, it is calculated 28,000 h.p. could be developed. This is much the largest power on this river in the province, though three others are rated in the neighborhood of 1,000 h.p. minimum natural flow.

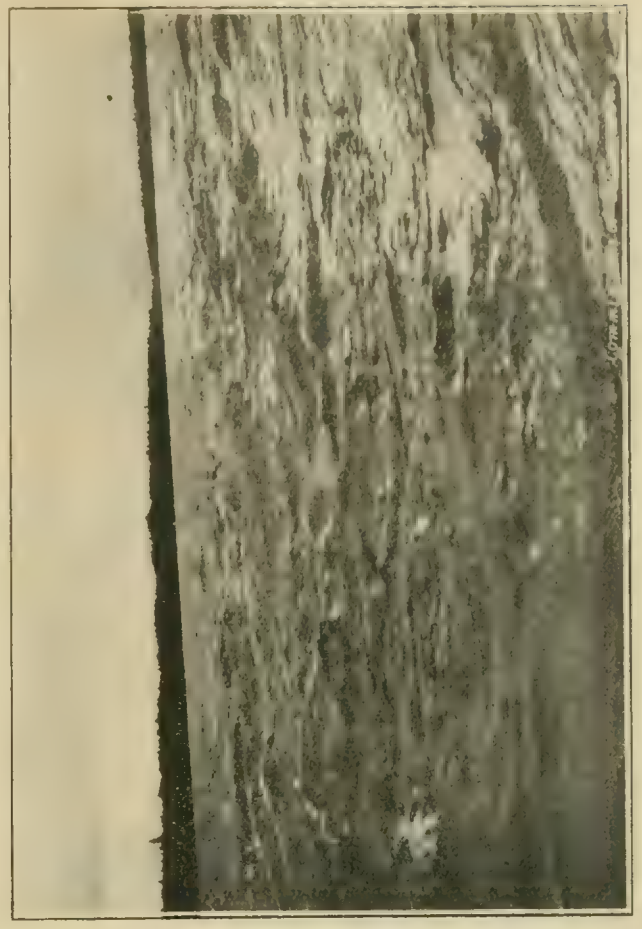
The south branch of the Saskatchewan rises in the extreme southern part of the province of Alberta and is augmented by a number of tributaries—the Red Deer, the Bow, Belly, St. Mary and others. On the Belly River midway between Macleod and Lethbridge there is an estimated power of 1,200 h.p. On the South Fork River, near the West Kootenay Pass, there are three powers estimated at less than 1,000 h.p. each, minimum flow. On the Crow's Nest branch, there is a possible head of 40 ft. and a minimum development of 300 h.p. On the St. Mary River and other small creeks and rivers immediately north of the boundary line there are a number of comparatively high falls of very small capacity. One on the St. Mary is rated at 384 ft. head, with 3,400 h.p. minimum. Another on Tib Creek has a fall of 349; another on Oil Creek has a fall of 250 ft., but the minimum development is only 392 h.p. Other small falls in the district are 158 ft., 127 ft., and 50 ft. high, respectively. On the Bow River tributary of the South Saskatchewan, there are a number of falls of considerable size, varying in head from 12 to 70 ft. At Bassano there is a drop of 38 ft.; at the city of Calgary, a fall of 12 ft.; at Radnor, a fall of 44 ft. and a minimum of 3,500 h.p.; Ghost Fall has a head of 50 ft. and a minimum of 4,000 h.p.; Mission, a fall of 47 ft. and a minimum of 3,200 h.p.; Bow Fort, a fall of 66 ft. and a possible regulated development of 11,240 h.p. Horseshoe Fall has a drop of 70 ft. and a regulated capacity of 11,910 h.p. At this point the Calgary Power Co. has installed a capacity of 19,500 h.p. At Kananaskis Falls the Calgary Power Co. has 12,000 h.p. installed. At Banff there is a 64-foot head and a minimum development of 1,500 h.p. On the Elbow River there is a head of 225 ft. and a minimum development of 4,500 h.p. possible. On the Kananaskis River there is a series of falls, 70, 70 and 45 ft. On the Cascade River, a 64-foot head with a calculated regulated capacity of 1,450 h.p. On the Spray River a fall of 50 ft. is available. On Lake Louise there is already a small C. P. R. plant in operation, generating about 130 h.p.

It will thus be seen that though the River Saskatchewan and its tributaries traverse three provinces, there is probably little in excess of 200,000 h.p. natural minimum capacity in its many water-falls. The chief characteristic of the rivers that rise in the Rockies, is the extreme variation between maximum and minimum discharge—sometimes as great as 200 to 1—and the sudden rises that occur in these streams. The North Saskatchewan and South Saskatchewan receive the greater portion of their flow from the mountains and are affected by extremes of temperature in the high altitudes. In these rivers and in the main Saskatchewan the discharge varies greatly during the year; high water and floods, due to warm rains and hot weather in the mountains, usually occur during July and August, while the low flow occurs during February and March. This also applies to their mountain tributaries and consideration of this is a factor of vital importance in designing hydro-electric developments on these streams. At The Pas the range between these two periods is ordinarily some 15 feet, which, at Grand Rapid, is gradually lessened, to from four to five feet, with an extreme of some six feet. During the spring break-up, the field ice of Lake Winnipeg occasionally becomes jammed at the mouth of the river, damming the outlet and causing rise at the lake of from 12 to 15 feet.

It is thus exceedingly difficult to form an estimate of any of the powers on this river. Under regulated flow possibly a million horse power or more is available. It would appear, however, that the development of the waterfalls must wait a general scheme of regulation which would be far too expensive for any single municipality to undertake.

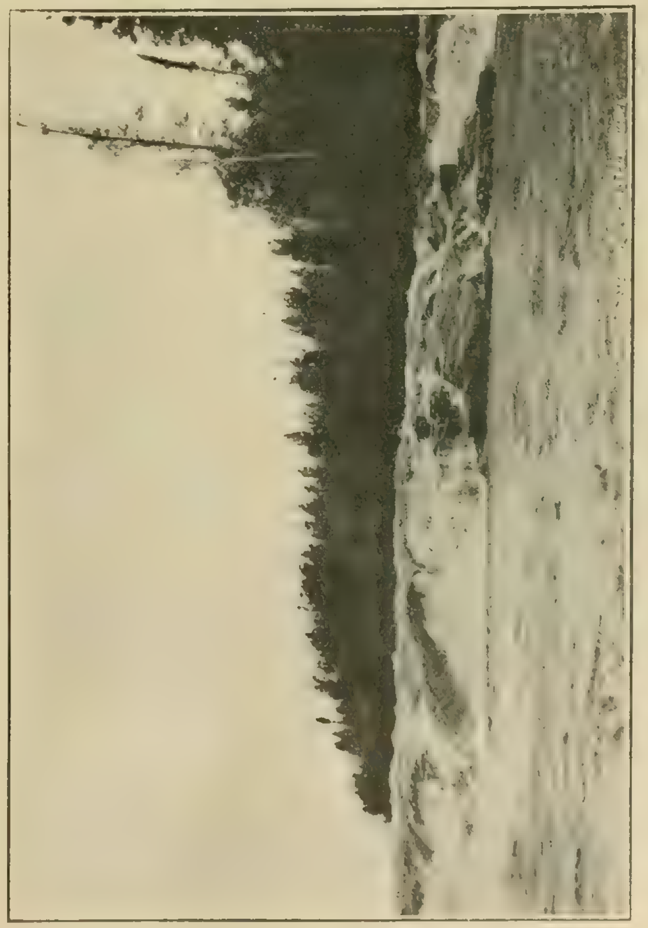


Saskatchewan River—Grand Rapid



Saskatchewan River—Red Rock Rapid

Hayes River—Knife Rapid



Hayes River—Trout Fall

The Dealer and Contractor

Some Dangers of Selling Cooking Appliances at Low Prices

By J. E. Bullard

In a recent issue of the National Electrical Contractor, Mr. J. E. Bullard advances a number of good arguments in favor of maintaining prices on electrical appliances. Chief of these reasons, perhaps, is that it means a certain guarantee of co-operation between the manufacturer, the jobber, the dealer and contractor, owing to the fact that each party to the agreement is making a fair profit. This co-operation is necessary to ensure a continuation of the popularity and continually increasing demand for electrical appliances. This and other arguments are elaborated in the following extracts taken from Mr. Bullard's paper:

The statement has been made that electric cooking appliances should be sold at low prices by central stations, just as gas cooking appliances have been sold at very low prices by gas companies. The reasoning that gives rise to this statement is based upon the theory that all you have to do to persuade people to cook with electricity is to install the electric appliances in the kitchens. Many very grave dangers lurk in this theory. I will deal with only four of them here. These four are the following:

1. The danger of seriously limiting the distribution of the manufacturers.

2. The danger of alienating the contractors and the dealers.

3. The danger of lowering the grade of salesmanship displayed in selling this form of service to such an extent that its efficiency is seriously crippled.

4. The danger of giving the public an exaggerated idea of the profits on the sale of electric current.

What I am about to say in regard to these dangers is not theoretical. It is based upon twenty-five years of actual selling experience. Fifteen of these years were spent in competitive fields. Ten of them have been spent in the public utility field. Five of the ten were spent in selling all kinds of electric service and five in selling all kinds of gas service. I have made some experiments with selling prices and have analyzed the results of many selling methods.

Limiting Distribution

We will consider the danger of seriously limiting the distribution of the manufacturer. At the present time in the electrical industry the manufacturers are spending immense sums in national publicity. This is rapidly educating the public to the value of electric service. This publicity work is possible only because of the wide distribution that these manufacturers have. They do not rely solely upon central stations. Their goods are found on sale by electrical contractors over the entire United States. This wide distribution tends to educate the public and to make it feel that the electric business is not such a monopolistic business as the gas business. Every person who says a good word for electric appliances helps sell electric current. Only so long as the distribution of the manufacturers is very thorough, however, can we hope to have many people praising these appliances.

Putting the case in a few words: If central stations begin selling electric cooking appliances at low prices, there is every reason to fear that the distribution of the appliance manufacturers will soon be so greatly reduced that they can no longer afford to do national advertising, and the reduced number of people to whose interest it will be to praise electrical appliances will more than offset the slightly larger number of appliances that the electric companies themselves may be able to sell.

Alienating Contractors and Dealers

The second danger to be considered is the one of alienating the contractors and dealers if central stations begin selling electric appliances at cost or less. Gas men often complain that in the electric business every one is boosting for electricity. The contractors, the dealers, and the architect all seem to be in league with the electric light company. In the gas business, on the other hand, the plumber seems as likely to suggest electricity as he is to suggest gas, while the dealer is pretty sure to try to sell a coal range rather than a gas range. The most that can be expected of the dealer is that he will compromise by selling a combination coal and gas range.

The reason for this difference in conditions is easy to see. Up to the present it has been to the interest of the contractors and the dealers to boost electricity. The contractor has been able to make a profit on all the appliances he can sell as well as on the electric wiring. In the gas business about all the plumber can make a profit on is the piping and sometimes the gas company will contract to do this for less than he can do it at a real profit. The result is that he has as little to do with the gas business as he can. When anyone asks his advice he is far too prone to speak in anything but complimentary terms of the gas company.

The phenomenal success of the electric business has been due in a marked degree to the hearty, healthy co-operation that exists between the contractors, the dealers, and the electric light companies. It is so valuable that the industry cannot afford to lose it. Selling cooking appliances for low prices is likely to be done without first consulting the contractors and the dealers and to be followed by the sale of other appliances at too small a margin of profit to allow the dealers and contractors to handle them. The result will be that dealers and contractors can no longer afford to sell them, and, therefore, will recommend something else that gives them a living profit when electrical appliances are called for.

Lowering Quality of Salesmanship

The third danger and possibly the greatest one of all lies in lowering the quality of salesmanship employed in selling appliances to a disastrous degree. The idea of selling appliances at a low price is based upon the theory that price alone will sell goods. The man who carries out this idea will accordingly say, "Why should high-grade salesmen and advertising men be employed? Just announce to the people how cheap the appliances are sold and they will buy them. No salesmen are required. Ordinary order-takers will do just as well." Of course, one experienced in selling realizes how ridiculous this reasoning is.

At one time I had the privilege of comparing two districts that had been opened up for a new gas company. One district had been opened on the low-price theory; the other on the high-grade salesmanship theory. In the low-price district there were more complaints and a smaller average monthly consumption than in the other district. A demonstrator made a house-to-house survey of each district. In the first she found very few satisfied consumers. In the second, where only high-grade salesmen had been employed and higher prices secured, she found very few dissatisfied consumers. This clearly demonstrated the fact that it paid better to employ high-grade salesmen and sell the appliances at a profit than to employ low-grade salesmen and sell the appliances at less than cost.

The fact has been pretty thoroughly demonstrated that **just as many, if not more, appliances can be sold at a profit by employing highgrade salesmen as can be sold at less than cost with low-grade salesmen.** Where high-grade salesmen are employed the consumers are pretty sure to be satisfied. The salesman must actually sell the idea of electric cooking in order to persuade the consumer to pay the high price for the appliance. If the price of the appliance is low enough, the consumer may buy it because she thinks she is getting a bargain and with the idea that she will use it for emergencies. Nothing, therefore, is really gained by selling appliances at low prices except a number of small consumers, which, under a system of higher grade salesmen, would have been large, or at least larger, consumers.

Sell Electricity—Appliances Sell Themselves

In selling electric cooking service it must always be borne in mind that it is electricity that is really being sold rather than appliances. Unless the idea of cooking with electricity is sold, the consumer will not use much current for cooking, regardless of how cheap the appliances are sold. If the consumer is thoroughly sold on the electric cooking idea she will, sooner or later, purchase the appliances required to cook that way, no matter how high the price at which they are sold. It, then, is not the appliances that must be sold. They will sell themselves if the cooking idea is sold. Simply reducing the price of the appliances and installing a large number of them deceives the central station because so many are placed upon the lines before the consumers are convinced that there are many advantages to electric cooking. Before these people will cook very extensively with electricity it will be necessary to convince them of the many great advantages connected with this new method, and it may be harder to do so after the appliance is installed than before.

High-grade salesmanship is required to sell the cooking idea. Low-grade men can sell appliances at less than cost. The aim of the central station, however, is to sell current. If it reduces the selling price of the appliances on the theory that all that is necessary is to install these appliances in order to get the people to use current, it is pretty sure to reduce the grades of salesmanship employed at the same time. The result will be that only the cheapest ranges handled by the company will be sold and the consumer begins the use of electric current for cooking purposes with the idea that it is very expensive and should be used only as an auxiliary to the coal or the gas range.

Giving Public Wrong Ideas

The fourth and the last point which we are to consider is the danger of giving the public an exaggerated idea of the profits on selling electric current for cooking purposes. This danger is more serious in the electric business than it has been in the gas business. At the present time, as has already been stated, the electrical industry is extremely fortunate in having in existence a fine spirit of co-operation between the central station, the contractors, and the dealers. This spirit exists because each of these people is allowed to make a legitimate profit on all appliances sold. Remove this profit and the contractors and the dealers are forced to turn against the central station. One of the results of this action will be the installation of many isolated plants.

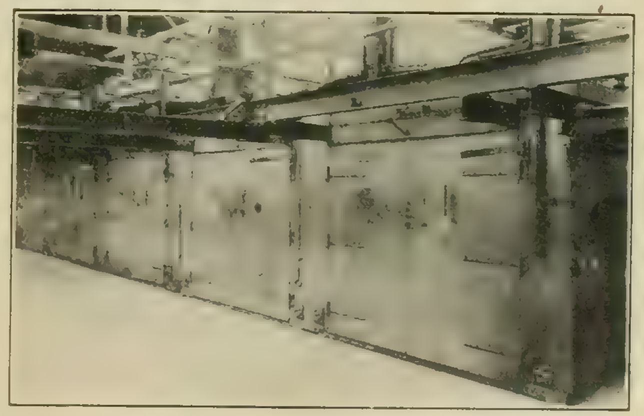
A study of modern methods will very soon demonstrate that it is not at all necessary to sell electric appliances at low prices. There is probably no industry that is composed of more capable men than the electrical industry. This being the case it is self-evident that what can be done in any other industry can be done as well, or even better, in the electrical industry.

Electrically Heated Japanning Ovens—Advantages Over Gas or Other Heat Source

The recent extensive adoption of electrically-generated heat for baking japans and varnishes and other protective coatings has served to focus the attention of manufacturers and of central stations upon this comparatively new application of electrical energy. In Canada, and perhaps more particularly in Ontario, the manufacturers have been recently making numerous industrial applications of electrically-generated heat. Many have been surprised to find that it is possible for electrically-generated heat to compete successfully with heat obtained by the direct combustion of fuel, and particularly with heat derived from gas, which had become almost standard practice in these arts.

It is easy to calculate equivalent prices of gas and of electrical energy—that is prices which will give equal costs for heat energy. Thus, if it be assumed that, say, 75 per cent. of all the heat energy latent in the gas can be obtained within the oven, it will be found that about 4,500 B.t.u. supplied in gas is the equivalent of 1 kw.h. converted into heat within the oven. With 600 B.t.u. gas this makes 7.5 cu. ft. of gas the effective thermal equivalent of 1 kw.h. of electrical energy.

On such a basis electrical energy would have to sell at about .75c per kw.h. to give the same heating costs as are obtainable with city gas at $1 per thousand. There are localities in which electrical energy is purchasable at such rates in comparison with gas as to make electrical heating show the lower energy costs, but in most large industrial centres this is not the case.



Exterior view of ovens installed at Weston.

In the face of such analyses, electrically-heated japanning and similar ovens are being installed by progressive manufacturers in locations in which gas is procurable in quantity for 50c or less, and in which electrical energy wholesales at from 0.8 to 1.2 cents per kw.h.

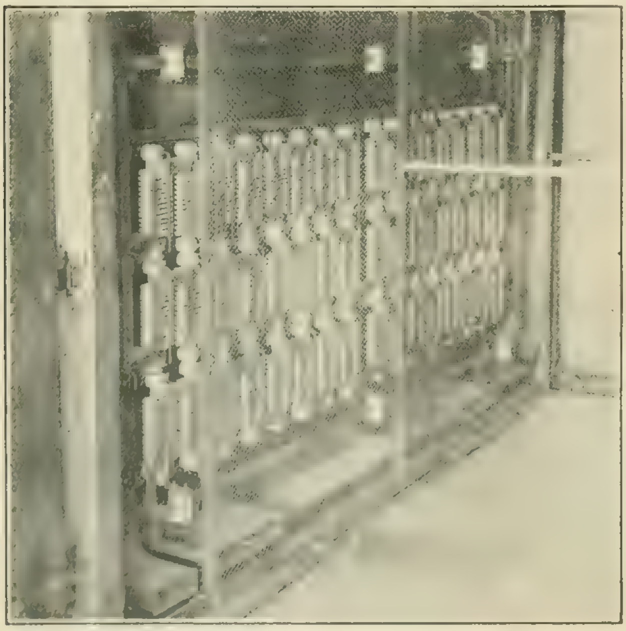
The reasons for such action are well grounded and sound. Rather curiously, they are of exactly the same sort as those which in an earlier period of the development of these arts led manufacturers to adopt gas firing in preference to coal or coke firing.

If a coal fired installation be assumed to have a thermal efficiency of only 50 per cent. and a gas-fired installation be assumed to have an efficiency of 100 per cent., city gas would have to sell at about 9c to give the same cost for heat energy as would be obtained with coal at $2 per ton. And yet manufacturers the country over have used gas firing for years at energy costs from five to ten times those obtainable with coal firing.

Obviously, relative energy costs do not tell the whole story, and, equally obvious, the part of the story they do not tell must be of considerable importance to have justified manufacturers in using gas during the past decade with such a weighty differential against it.

The crux of the whole matter lies in the fact that the the cost of energy used for heating in such processes is negligibly small in comparison with all of the other costs which go to make up the total cost of the product. In general, the cost of the japan or other protective coating material exceeds the cost of energy used for heating. Similarly, the labor item is generally much higher than the cost of energy. Again, the cost of reworking one spoiled piece is equal to many times the energy cost for baking a number of pieces.

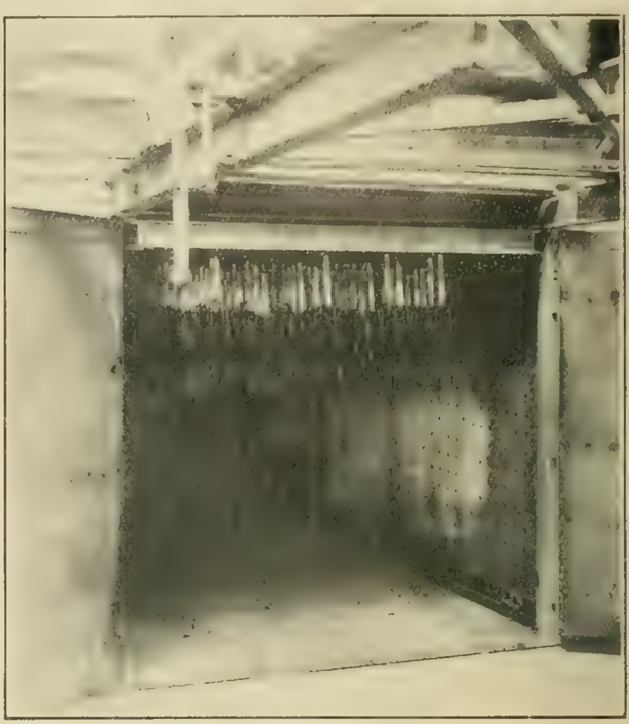
The cheapest method of heating is that which reduces to a minimum the total cost of a satisfactory product. If improved quality has a money value a selling value, or any other value it may even make a process showing a higher total cost the cheapest in the end. Electrical heating in japanning and similar industries has been adopted by many representative manufacturers of products of nation-wide reputation because they found that it gives the lowest cost of production when all things are considered.



Showing compact installation of heaters.

It is interesting to note that the use of electric heaters for japanning and similar installations is spreading rapidly, despite the fact that the manufacturers of such equipments have made little effort to sell them because of the difficulties experience in making reasonable deliveries under the abnormal market conditions which have existed for the past year or more. The users themselves are calling for electric heating, and this can mean but one thing—a sound reason for its existence and use.

In view of all these facts it is obvious that argument is no longer necessary to prove the economic feasibility of heating japanning and similar ovens electrically under proper conditions. The events of the past few years furnish ample evidence; the method is here, and is in use and is giving economical results. The advantage obtainable with electric heating in this field are:



All points of oven at same temperature.

1. Perfect heat control.
2. Great speed of production.
3. Very high quality.
4. Absolute safety; and,
5. Low production cost.

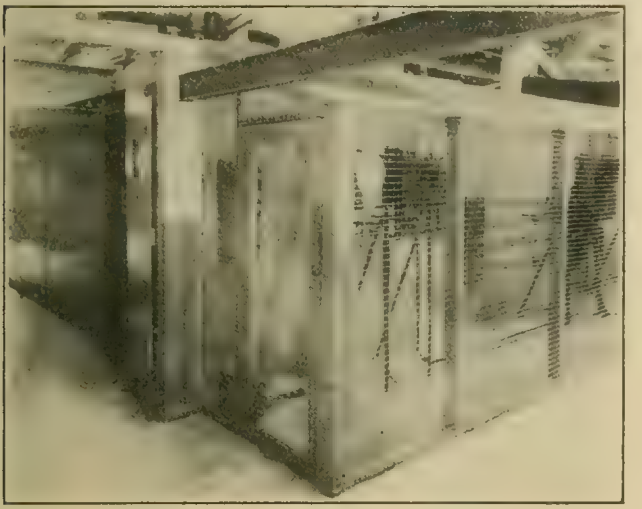
Electric heating units are of comparatively small size, can be placed in almost any position, and can be moved readily from one position to another until the most desirable location for each individual heater is found. As one example of such flexibility, consider the single-ended, box type of oven. Japanners have accepted as inevitable a higher temperature near the ceiling than near the floor. With electric heating units of the proper sort it is just as easy to hang heaters on the doors as it is on the stationary walls, and it is equally easy to place them on the floor. This makes it possible to obtain practically uniform temperature distribution throughout the entire oven, and this leads to high quality and high speed. Again, assume a long, continuous type of oven, so arranged that the work is carried through it on a conveyer. There is some combination of temperature along the run of such an oven which will give the best work in the shortest time, and the flexibility of the electric heating units adapts them ideally to the determination and the maintenance of such combinations.

Electrical heating is by its very nature capable of perfect and certain control. Control in the sense in which it is here used covers two different functions, which may be distinguished as graduating and as limiting. Thus it is possible to control automatically the rate at which the temperature increases toward a maximum, and it is also possible to limit very definitely the maximum attained. The former sort of control is found to be practically equal to the latter in importance when maximum quality and speed are desired.

The perfect control possible with electric heating and the speed attainable lead toward decreased cost of production, both by virtue of decreased labor charges per unit of production and decreased losses in spoiled work. Moreover, electric heating lends itself very readily to combination with various automatic methods of handling material which tends still further to a reduction of labor charges.

The time will undoubtedly come very shortly when every central station will have identified with its organization an industrial heating specialist, as this field is developing fast.

It would greatly facilitate matters if central stations would exercise special care and thought in furnishing complete information when a heating problem is submitted for consideration. The following outlines in general the information required, in order that a proposition may be intelligently considered, but any other data which may have a bearing on the subject should be included:



Automatic control in fool-proof case.

1. Give full description of the work to be done, whether baking, drying, melting, evaporating, tempering, etc.

2. Include, if possible, a drawing or sketch of the oven, machine, kettle, drum or receptacle, etc., in which the heating operation is carried on. This drawing should show all dimensions, and there should accompany it a description of the construction of the oven, machine, etc., the material of which the walls are constructed, thickness, amount of insulation. Give the weight of the parts which are heated such as kettle or drum or where an oven is being considered if a truck conveyor or rack is used, give its weight. Amount of ventilation per hour.

3. Describe fully the heat-treating process and the method of operation, whether hand-fed, automatic, by truck, or conveyor, etc.

4. Amount of material put through the heat-treating process per hour. If metal, the number of pounds; and if metal parts, the dimensions. If liquid, the number of gallons. If moisture is to be evaporated, what per cent. of the total charge.

5. Temperature required for the work and time required to reach that temperature with present method of heating. Is constant or available temperature required?

6. Space available for installation of electric heaters. This should be indicated on the drawing, giving dimensions of the space.

7. Voltage and frequency of available service.

The illustrations show a battery of ovens recently installed in the plant of the Canada Cycle & Motor Company at Weston, Ont., and used for the baking of enamel on bicycle frames and other bicycle parts. The electrical equipment was built by the Canadian General Electric Company, Limited, and the ovens themselves by the Brantford Oven & Rack Company, Limited. Operation of the electric ovens has made an improvement in the quality of the enamelled product and increased production. It also naturally eliminates the risk of gas explosion and fires. The largest electric oven of the battery has dimensions 15 ft. deep by 7 ft. 8 ins. wide by 7 ft. high. The working temperature is 350 degs. F., and a bake is secured every 45 minutes.

In this particular oven there are connected 18 wall-mounted heaters, each rated 4.1/4.8 kw., 275/300 volts, two heaters being connected in series across 550 volts, 3 phase, 25 cycle. The automatic control panels are mounted on pipe supports at the rear of the oven and are equipped with a reversing relay in the control circuit, which is operated by the thermostat in the oven. Thus at all times the desired temperature may be maintained.

Heaters

The heaters supplied represent the latest product of the manufacturing company, each unit consisting of a flat resistance ribbon, wound on special insulating blocks, which are slotted and fitted over the edges of a metal centre. The insulating materials are of a very special nature and will not crack or break even at extremely high temperatures. This type of heater has a high temperature range, some of them running as high as 900 degs. F. in the oven without fear of oxidization.

Labor Question Amicably Arranged

The president of the Toronto Electrical Contractors' Association, Mr. K. A. McIntyre, announces that the association has been able to effect an amicable settlement of the labor situation which has been absorbing their attention for some time. The schedule offered to the union by the association was accepted in the same friendly spirit in which it was given. This schedule applies to all union journeymen, and took effect on Monday, May 14. The main features are as follows:

Men formerly getting less than 50 cents an hour are to be advanced to 50 cents.

Men formerly getting 50 cents but in the opinion of the contractors not worth more than this amount will remain at 50 cents

Other men getting 50 cents or more will be advanced 2½ cents per hour to a maximum of 60 cents.

Men formerly getting 60 cents remain at that figure.

An important feature of the agreement is the recognition, to some extent, of the members that men should be paid according to their worth. We are convinced that if this idea were to prevail more generally benefits would accrue quite as much to the journeyman as to the master contractors. One of the weaknesses of a common wage for the members of a union is that it destroys individuality, initiative, and ambition. It is to be hoped this arrangement between the journeymen and the contractors' association is the first step toward an improvement in the old conditions.

Electrical Section C. S. C. E., Manitoba

The Electrical Section of the Manitoba branch of the Canadian Society of Civil Engineers met on May 9 in the University Building. Two interesting papers were presented, the first by Mr. H. McConkey, on the Morkrum telegraph equipment; the second by Mr. F. C. Griffen, on "Efficiency Tests of a Hydro-electric Unit." Mr. W. G. Chace, chairman of the branch, presided.

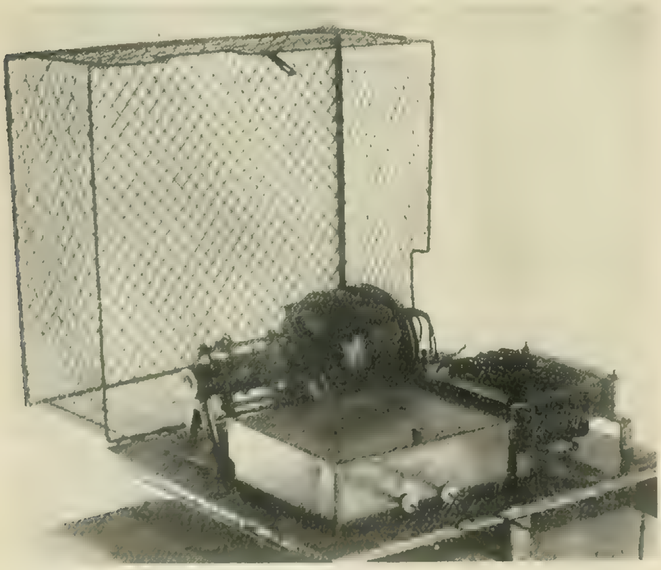
What is New in Electrical Equipment

A Current Converter for Motion Picture or Other Arc Machines

The use of direct current at the arc is almost universal. There is no objectionable humming, the arc is steadier, the light is whiter and stronger for given current value, and the arc need be fed only about one-third as often as with alternating current. In localities where direct current electricity is not available, theatre owners, up to the present time, have had to purchase a motor generator or rotary converter or a mercury arc rectifier. The latter machine has not gained as much favor as it otherwise might, owing to the expense involved in its upkeep. The motor-generator is a good machine, needs little care, and operates well up to its full load and beyond. However, the efficiency of the machine is quite low, and the first cost of the machine is high.

The Excelsior Electric Manufacturing Company, Toronto, are putting a machine on the market which, it is claimed, has all the good points of the motor-generator set as far as quality of light is concerned, and at the same time has overcome the objectionable features of high first cost and low efficiency. The machine was patented in Canada and the United States in 1916, and is hereinafter described.

The Excelsior current converter consists of a ¼ h.p., 110-volt squirrel cage induction motor, with extended shaft, upon which a commutator and two slip-rings are attached, the whole throughout running on self-aligning ball-bearings. In addition, as part of the equipment, there is a transformer and a polarity switch. The transformer changes the alternating current from, say, 220 volts to 70 or 60 volts, or whatever is desired, and this same voltage is available at the d.c. brushes.



Converter with cover lifted.

The polarity switch is a special feature of the machine. It is a double pole, double throw switch (Fig. 2), electrically operated and automatic in its action, serving two purposes—(1) it keeps the polarity of the outgoing current constant (that is, it makes it certain that the top carbon is always positive under all conditions); and (2) it makes the machine foolproof, inasmuch as the switch does not close until the motor is up to speed. This eliminates any sparking at the commutator. The relays which close the switch have a pull of about fifty pounds, and use less than 1/20 amp of current. The switch is only susceptible to direct current, and will not operate on alternating current.

The machine is best used on a 220-volt, three-wire, single-phase alternating current line. The motor is connected to the 110-volt, and the transformer to the 220-volt line. The motor, on a 25-cycle line, runs at 1,500 r.p.m., and on 60 cycles, at 1,800 r.p.m. The load on the motor is constant, irrespective of the power output of the machine.

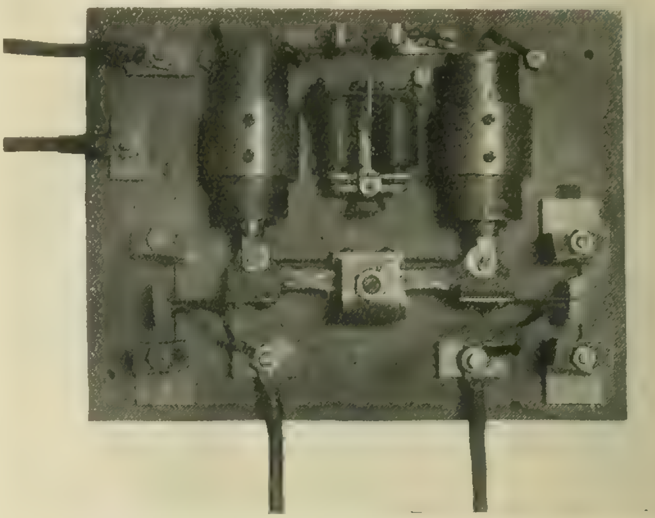


Photo of polarity switch, Excelsior converter.

All the parts are fastened to a base and covered with a hinged wire cage. The equipment is compact, neat, and absolutely fireproof. The material in the converter and the workmanship is of the best. The same workmen are employed by the manufacturer on making these machines as have been employed on tool and gauge work for war material in the same factory for the past two years.

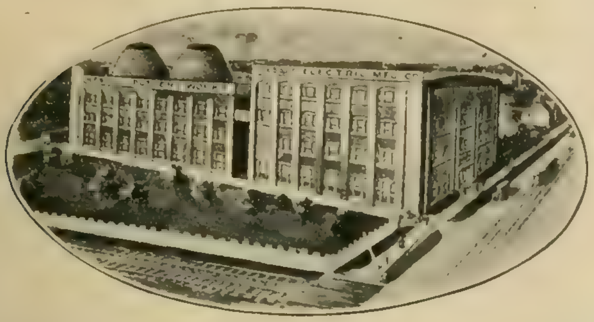
The efficiency claimed for the Excelsior converter is 92 per cent. A machine which will supply 45 amperes to one arc will also run two arcs in parallel for short periods between films without sparking. Machines to supply two arcs continuously can be supplied at very small additional cost. Freezing of the carbons does not cause sparking at the brushes and in no way injures the machine.

The very high efficiency of the equipment means a great saving in the cost of power per month. In addition, the first cost of the machine is half or less that of a motor-generator set. The Excelsior electric current converter is on sale and exhibition at Charles Potter's, 191 Yonge Street, Toronto. At this showroom customers and visitors may see pictures on the screen using pure alternating current, also using direct current from Toronto Electric Light generators, and 25-cycle alternating Hydro current converted by an Excelsior converter.

The Canadian Electrical Association meets in convention on June 7 and 8—Ritz-Carlton, Montreal. Old-time program with entertainment omitted.

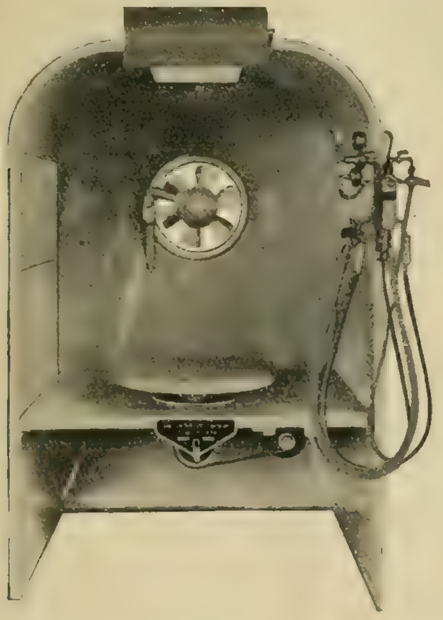
New Hessco Factory

The Hessco Electric Manufacturing Company, head office Toronto, has just erected a large new factory at Windsor, Ont., for the manufacture of their numerous lines of electrical equipment. This is claimed to be the only factory in America in which the porcelain as well as the brass parts of their equipment will be manufactured complete.



Compressing Air Spraying Outfits With Electric Heater and Electric Exhaust Fan

The Aeron system for spraying the finish on wood and metal products with compressed air contains several new features which add to the convenience and economy of finishing materials by the spray process. The outfits are made in a wide range of capacities for handling very small parts or large pieces such as automobile bodies. The booths are constructed of heavy sheet steel on an angle iron frame,, with wire glass windows in the sides and top and with a sheet steel floor. Reflectors and sockets are built in the booths for lights and a portable spotlight is also supplied, so arranged that it can be clamped on the frame in any desired position to direct the light upon the work. The back of the booth is funnel-shaped, the exhaust fan being mounted in the apex of the funnel. This construction gives better exhausting results than can be obtained with a flat rear wall. The exhaust fan used is of unique design. A 1/6 h.p. Robbins & Myers motor of special design is used to drive a 6-blade 16-inch fan. The motor is completely enclosed to protect it from the fumes, but is provided with thorough ventilation by a stream of cool air, which is drawn through the motor by the fan, the intake for this air being provided by a tube which opens outside the booth. This tube also serves to support the fan, and is so arranged that the fan will swing back from the opening to give access to the blades. The wiring for the fan motor is brought up through the air tube. The blade can be removed for cleaning by the removal of a single nut. The exhaust fan is made in one size only, two or more fans, depending upon the requirements, being used in the larger booths. Where desired, the sprayer is equipped with an electric heater, which heats the air and finishing material before it leaves the spray nozzle. As shown in the illustration, the outfits can also be furnished with a motor-driven turn-table for supporting the work. The speed of rotation is adjustable through a wide range by a friction wheel and disc operated by a 1/8 horse power Robbins & Myers motor. The table is started and stopped by a foot pedal. It can also be raised and lowered through a 10-inch range by compressed air acting upon a piston which supports the revolving parts.

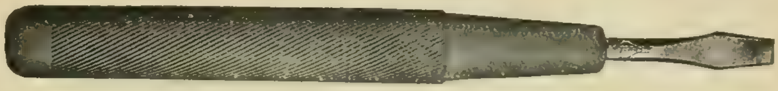


Transmission Line to Span River

The Shawinigan Water and Power Company are preparing designs for a 5,000 foot clear conductor span for the transmission of electric energy over the St. Lawrence River at Three Rivers, Que., which will supplement the submarine cable transmission line already installed. The two steel towers on which the line will rest at the extreme ends of this long span will have a concrete base, set some little distance from the bank of the river. These towers will be 350 feet high so as to provide a clearance of 160 feet in the centre of the span. The three conductors will be placed approximately 50 feet apart. The transmission line will not be anchored to the towers themselves but merely supported by the towers and anchored to concrete blocks located some distance to the rear of the towers.

Screw Driver With Fibre Insulated Handle

A screw driver that is insulated so as to be safe in the hands of a capable electrician at fairly high voltages is manufactured by the H. H. Mayhew Company and illustrated herewith. This driver is 9 inches long and insulated to within 2 inches of the point by a special fibre handle, cast as one piece over the metal. The whole tool is treated with a lacquer, which gives it a pleasing appearance and makes it moistureproof. Tests which have been conducted on these screw drivers by the Electrical Testing Laboratories of New York have shown that they will stand, without puncture, voltages up to 16,000 under the ordinary conditions for which this tool would be used.

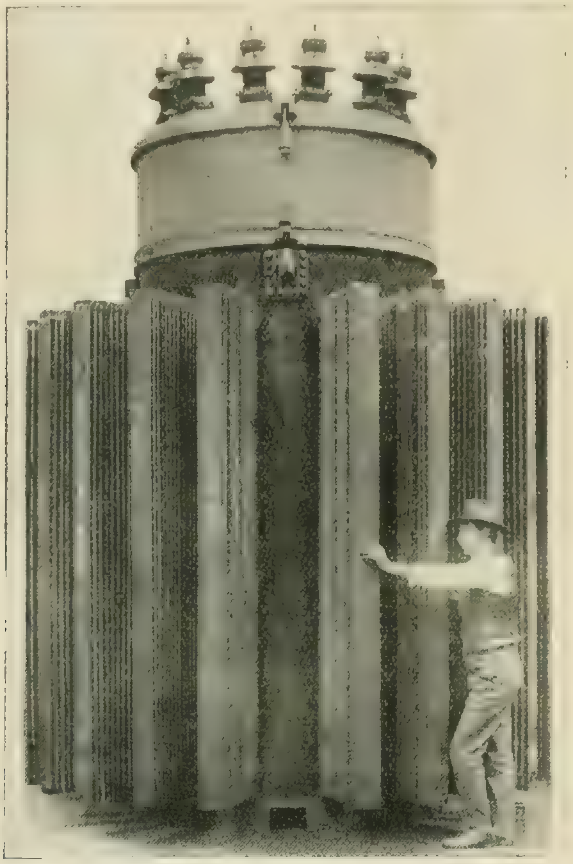


New Book

"Electrical Meters," by C. M. Jansky, B.S., B.A., electrical engineer, University of Wisconsin; McGraw-Hill Book Company, Inc., New York, publishers. This is the second edition of this well-known book, which the author has thought best to publish on account of the many new development in electrical meter design; this has necessitated the omission of some and the addition of much new material in the present revised edition. The description of most obsolete meters has been omitted and several new designs are included. The chapter on "Instrument Errors" has been almost entirely rewritten and expanded so as to include many experimental results. The influence of frequency and wave form in producing errors in different classes of meters has been added; also a chapter on instrument transformers. Price, $3 net; 5½ x 9 inches; bound in standard green cloth of this publisher; 416 pages; well illustrated.

Large Radiator-Type Regulator

In the accompanying illustration is shown the largest self control induction feeder voltage regulator ever built. The regulator, which is of the oil-insulated, self cooling type, was made by the Westinghouse Electric & Manufacturing Company. It is rated at 600 kv.a., three phase, 60 cycles, 13,200 volts, with 10 and 20 per cent. regulation at 262 and 131 amp. respectively. The regulator is designed for operation outdoors with full-automatic control self-contained. It was built for the Southern Power Company and is to be connected to the low-voltage side of a 6,000 kv.a. bank of 44,000/13,200 volt transformers on the power company's line at Spray, N.C.



Jiffy Ceiling Light Hanger

There has long been a demand for a simple ceiling light hanger to meet general conditions. In the "Jiffy" hanger the installation is accomplished in a "jiffy." The several cuts below fully illustrate its various applications. A long threaded hook is provided, and when the ceiling light is fastened securely into the desired position by means of the ball-nut, the projecting wire is cut off with a pliers, which burrs the end, leaving a permanent fastening that cannot jar out of place. Fig. 1 shows the hanger hung off centre to suit conditions; Fig. 2, hung under a faulty condition, and Fig. 3, hung to ears or lugs of box. A simple collar attachment for hanging to gas drop, of any length, is also provided by this company.

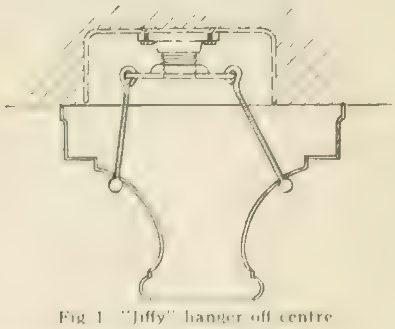


Fig 1 "Jiffy" hanger off centre

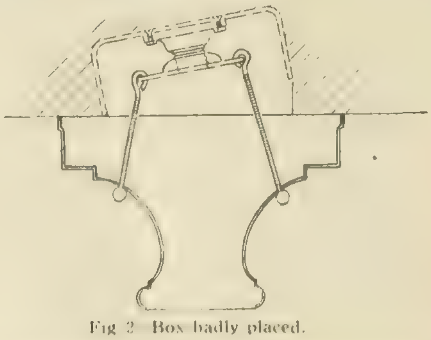


Fig 2 Box badly placed.

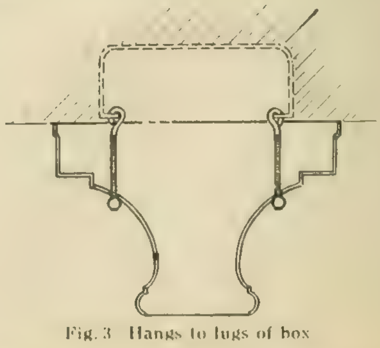
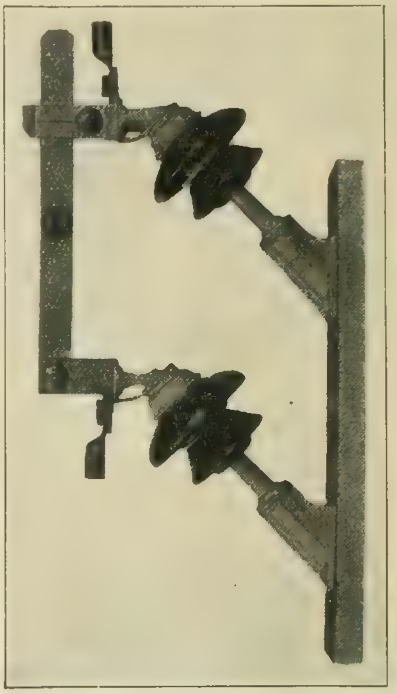


Fig. 3 Hangs to lugs of box

Outdoor High Tension Disconnecting Switches.

Continuity of operation is of the highest commercial importance, and a high tension distribution system should be so designed and installed that trouble in branch circuits can quickly be localized. If all branch circuits or feeders be equipped with disconnecting switches, then, in case of trouble, these switches can be opened and a disturbance localized. By the use of such switches a defective section can be isolated and the remainder of the system operated. Disconnects also enable quick and safe testing of the lines and location of trouble, etc. The switch illustrated is manufactured by the Delta Star Electric Company, of Chicago, and is primarily intended for sectionalizing purposes, controlling outdoor sub-stations, transformer banks, etc. While rated at 13,200 volts, the switches employ 27,000 volt insulators, with flash-over test of 100,000 volts. This design ensures that flash-over will occur before puncture—an important requirement in avoiding service interruptions. These switches are also made in all standard potentials up to 66,000 volts and in various ampere capacities.



Outdoor disconnecting switch, 13,200 volts.

New Power Plant, Canadian Cottons, Ltd., Cornwall, Ont.

The Canadian Cottons, Ltd., Cornwall, Ont., who are constructing a new power plant for their extensive cotton mills at Cornwall, Ont., have let the contracts for the various apparatus as follows.

The boilers will be furnished by the Babcock & Wilcox, Ltd., of Canada. The capacity of the boilers is 618 h.p., normal rating. These boilers will be equipped with Sanford Riley automatic stokers, and will be capable of forcing the boilers to 250 per cent. of their rating.

The turbo-generators are of the extraction type, taking steam at 200 pounds pressure and 175 degrees superheat and extracting for manufacturing purposes 20 pounds. They will be furnished by the Canadian General Electric Company.

The condensers will be furnished by the C. H. Wheeler Manufacturing Company, of Philadelphia. Removal air pumps will not be used in this plant, but instead the Wheeler Company's radojets will be employed.

The contract for the water heaters has been made with the Canada Foundry Company, of Toronto, for the well-known Cochrane heater.

The Permutit Company, of New York, have the contract for the water filtering and softening plant. This plant will consist of the well-known Permutit filtration equipment

The contracts for the coal and ash handling equipment have not yet been placed, but will be in the very near future.

The Canadian Cottons, Ltd., of Cornwall, have very extensive cotton mills, and require for manufacturing, dyeing, etc., a large amount of steam, which is now generated by horizontal return tubular boilers. These boilers have been in service for some thirty years, and have reached the limit of their service, hence the necessity for the new boiler plant; and, inasmuch as 25 to 50 tons of coal per day are required for making steam, this steam will be obtained with slight addition to the coal expense by generating at a high pressure and extracting 20 pounds.

The steam plant will serve two purposes—first, to give additional power, and, second, to take care of the shortage of power when the water is out of the Cornwall Canal each year, and again when the St. Lawrence River backs up some 25 feet and cuts down the head on the hydraulic plant. This condition prevails not only in the private plants in Cornwall district, but also in the plants serving light and power for general public use.

The power plant is being built by the Canadian Cottons, Ltd. Mr. R. S. Kelsch, Montreal, is consulting engineer.

Bell Telephone Staff Changes

Several staff changes have been made in the Eastern division of the Bell Telephone Company. Mr. L. Belcourt has been appointed district superintendent in charge of District No. 1 and Areas 41, 45, and 46 in District No. 4, headquarters at Quebec, and Mr. R. Neilson, district superintendent in charge of District No. 2, 3 and Areas 42, 43, and 44 in District No. 4, headquarters at Montreal. Area No. 34, Valleyfield, is divided and known as Areas 34 and 34A, No. 34 comprising Valleyfield (headquarters), Beauharnois, Caughnawaga, Chateauguay, and No. 34A, Huntingdon (headquarters), Howick, Ormstown, St. Chrysostome. Mr. L. Gauthier has charge of No. 34 for operating and Nos. 34 and 34A for plant, while Mr. W. B. Rennie has charge of No. 34A for operating only. Mr. L. Gauthier, local plant chief of Valleyfield, will also act as local manager, replacing Mr. L. J. Papineau, who becomes local manager of Granby, in succession to Mr. W. A. Whitehead, resigned. Mr. L. Corio is appointed local manager of Grand'Mere, succeeding Mr. J. A. Filion, who has been transferred to St. Jerome as local manager. Mr. Papineau was recently entertained at dinner at Valleyfield on the occasion of his promotion.

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Stop wire losses thru acid fluxes. Make stronger, safer splices with

ALLEN
Non Acid Sodering Flux

3 times stronger than acid can't start corrosion.
Sample for your Dealer's name.
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HOUSTON & CO., Ltd.
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"In the Soderman's game since '93"

Use a fuse which will really protect those small motors—you can if you install the 1-10 to 1-4 horse power sizes of

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SINGLE PHASE MOTORS

Such a protecting fuse will usually be of sufficient capacity to successfully start the load.

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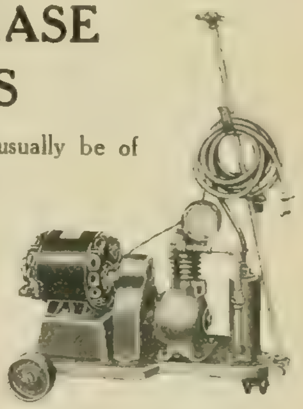

Illustrating a small garage compressor driven by a ¼ h p motor

Century Electric Company
19th, Pine to Olive Sts., ST. LOUIS, Mo., U.S.A.

Stock carried in Canada by: 47
Jones & Moore Electric Co., Ltd., 294 Adelaide St. W., Toronto
Great West Electric Co., Ltd., Winnipeg
Rudel-Belnap Machinery Co., Ltd., Can. Express Bldg., Montreal
Rankin & Cherrill, 55 Hastings St. W., Vancouver, B.C.

Tenders

A few dollars spent in advertising your proposals in the

Contract Record
and Engineering Review

would result in additional competition, which might save your city or town or your client many hundreds of dollars.

Current News and Notes

Alliston, Ont.

The ratepayers of Alliston, Ont., unanimously passed a by-law in favor of linking up with the Hydro-electric Power Commission of Ontario. A second by-law authorizing a debenture issue to cover the cost of installing a local plant was also passed with only three dissenting votes.

Brantford, Ont.

The Brantford township council will shortly submit a by-law providing for an agreement with the Ontario Hydro-electric Power Commission for the purpose of securing service throughout the township.

Campbellford, Ont.

The town council of Campbellford, Ont., recently passed a by-law authorizing the expenditure of $19,000 for the purpose of extending and improving the present electric light and power system.

Hamilton, Ont.

The latest report of the Hamilton Hydro-electric Commission shows a total of 15,127 consumers and a load of 25,557 horsepower.

Kingston, Ont.

In connection with the work of extending Hydro power from Napanee to Kingston, Ont., it is anticipated that the line will be finished about the end of August.

Montreal, P.Q.

La Compagnie Centrale d'Electricité, Ltd., has been incorporated, under a Quebec charter, to develop water powers for supplying power or light within the Counties of Chicoutimi and Lake St. John. The capital is $99,000. The principal place of business will be at Hebertville Station.

McGill University announce the names of the successful candidates for the degree of bachelor of science in electrical engineering, in order of merit: Silver, Benjamin L., Brooklyn, N.Y., U.S.A.; Hodgson, Jonathan Archibald, Montreal; Buckland, Arthur Leland, Way's Mills, P.Q.; Sandison, William Ross, Winnipeg; Clough, Roy Brainerd, Ayer's Cliff, P.Q.; Brown, Harry Cleophas, Moncton, N.B. Prizes and honors in science include: Buckland, Arthur Leland, honors in electrical engineering; Clough, Roy Brainerd, prize for summer essay, second prize for paper read before the Undergraduates' Society of Applied Science; Gardner, William McGregor, honors in elements of electrical engineering; Hodgson, Jonathan Archibald, honors in electrical design; Silver, Benjamin L., British Association medal, honors in electrical design.

The Montreal electrical members of the Canadian Society of Civil Engineers are taking a prominent part in the campaign for co-operation with the Honorary Advisory Council of Scientific and Industrial Research. Mr. R. A. Ross and Mr. A. Surveyer are members of that council, and the former is also chairman of a voluntary committee for the distribution of questionnaires to manufacturers, universities, technical and other societies throughout Canada. Messrs. A. Surveyer, Julian C. Smith, R. M. Wilson, K. B. Thornton, and J. M. Robertson have been appointed captains of Montreal committees to look after the distribution of the papers.

Renfrew, Ont.

The town council of Renfrew, Ont., have purchased the business and water privileges of the Renfrew Power Company for $100,000, which will, it is claimed, be a very profitable investment, the revenue in 1916 being [illegible]2,000.

Scarboro Twp., Ont.

An agreement has been signed by the township of Scarboro and the Hydro Commission for the construction of a transmission line to cost $20,000. Work will be started at once.

Toronto, Ont.

The Hydro-electric Power Commission of Ontario have purchased a lot 90 by 130 feet situated to the north of their present office building on University Avenue, Toronto. The purchase was made to provide for future extensions to the building.

Verdun, P.Q.

The city of Verdun has accepted the plans and specifications for an underground conduit system, prepared by Mr. A. S. Clarson, the engineer. The estimated cost is $225,000.

Winnipeg, Man.

The electrical workers of Winnipeg, Man., returned to work after being out on strike eight days. A compromise agreement was arranged.

Personals

Mr. D. H. McDougall, manager of the Toronto Electric Light Company, was elected vice-president of the National Electric Light Association at their recent convention in New York City on May 9-10. Mr. McDougall, at this convention, gave an exhaustive review of conditions in Canada, brought about by the war, in the central station field, and was able to assure United States operators that there was no reason for a panicky feeling. The increased demand that has been made on our manufacturers at various centres throughout the Dominion has been reflected generally in a similar increased demand upon our central stations for more electric power.

Mr. R. H. Balfour, chief engineer of the Montreal Electrical Commission, has been appointed sales manager of the Eugene F. Phillips Electrical Works, Ltd., Montreal. He graduated in engineering from McGill University in 1897, and started with the Lachine Rapids Hydraulic Company as assistant operating superintendent and joined the Montreal Light, Heat and Power Company in 1903, when the Lachine Rapids and other companies were amalgamated under that name. Mr. Balfour remained with the Montreal Light, Heat, and Power Company until June, 1915, holding at that date the position of assistant general superintendent. On leaving, he accepted the position of chief engineer of the Montreal Electrical Commission, his resignation from which will become effective on June 15. From this brief sketch it will be seen that Mr. Balfour has had a wide experience in the operating end and also in the design and construction of conduits, and the laying of cable—experience which will undoubtedly prove of great value in his new position.

Vancouver's Electric Show

Manufacturers and others interested are requested to get in touch with secretary E. Brettell, 781 Granville Street, Vancouver, B.C., regarding Vancouver's Electric Show, August 20th to 25th, 1917.

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Generation, Transmission and Application of Electricity

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Very Successful C.E.A. Convention

It is indicative of the fact that Canada is finding herself in this war that the Canadian Electrical Association, a gathering of all the private electric utility companies in Canada, should just have completed as successful a convention in Montreal as they ever had in the days before the war.

Since the outbreak of war the regular convention of this association has been much narrowed down, both as to time and numbers, but the members this year had reached that state of mind that war was no reason why the convention should be withheld and, indeed, was excellent reason why a convention was more necessary than ever. If in normal times it was an advantage to gather together once a year to discuss ways and means for the better coping with business snags, surely in abnormal times of war such discussion was many fold more important.

And so the events have proven it. A keener interest has never been manifested, or a better working attendance recorded. But it was all "business," the only exception being the "Dinner to Delegates"—(if eating together can be called an exception)—on the evening of Thursday, June 7, at which the delegates were the guests of the Montreal Companies' Section of the Association in the Ritz-Carlton. At this dinner the necessary opportunity was given of renewing acquaintanceships and recalling pleasant memories of former conventions for which otherwise, under stress of business, there would have been little time. For this opportunity the delegates were highly appreciative of the thoughtful attention of the Montreal Section. The business sessions were occupied in hearing reports of committees and discussing them, supplemented by interesting addresses from prominent central station men on both sides of the line. These included, among others, Julian C. Smith, chief engineer and vice-president, Shawinigan Water and Power Company; Mr. H. E. Howe, of Arthur D. Little, Inc., and Mr. A. Ward Harrison, National Lamp Works, Cleveland.

A report of the proceedings is printed at length elsewhere in this issue.

Is Canada British? Enforce Conscription and Find Out

The announcement of Premier Borden that he will authorize the raising of the necessary recruits, by conscription, to keep Canadian battalions in France at least up to present strength, receives without doubt the hearty approval of the vast majority of Canadian citizens. The most unsatisfactory and distressing feature of recruiting methods in the past has been the unfair distribution of responsibility and sacrifice which the voluntary system involves, both individually as citizens and collectively as provinces. The next most important objection to the voluntary system is its inefficiency, partly due to wasted energy in obtaining recruits, partly to injudicious allocation of the men after they have been secured.

We heartily support this latest announcement of the Premier, and trust he will not lose a single day in forcing the matter to its final conclusion. He must on no account allow himself to be deterred or delayed by the opposition which has developed in certain quarters. We do not believe this opposition has any substantial basis in fact. However, if it has, so much the more reason for forcing the issue, that we may know who and where the enemies of the Empire are that we are now falsely designating "citizens."

Time is the essence of the contract. Let us have conscription and have it quick. Necessity, justice, and loyalty alike demand it.

Country Before Party

The Liberal party of Ontario have shown themselves up in a most favorable light by their attitude towards conscription, as indicated, more particularly, by the meeting in Massey Hall, Toronto, on the evening of June 9. This attitude was all the more difficult in view of the situation at Ottawa, where the leader of the Government has just declared for conscription and the Opposition leader has declined to lend his assistance. What the political outcome may be no one, at the moment, can foresee, but also, as compared with the bigger question of national service, we hope nobody cares.

The man who thinks, first, of clinging to office or of manoeuvering conditions so that he may win office while our men at the front are calling for assistance, is scarcely the man who will hold public favor when the war is over and the electors have all the facts before them and have a chance to make a deliberate decision. Surely we can forget "party" for the term of the war. Surely the lives of our men are worth more to us than "office." And surely, too, the Liberals of Ontario have done a loyal and patriotic thing of which they will be glad in after years in that they have broken away from the leadership at Ottawa when that leadership suggests disloyalty to the Empire. It is an example of patriotism of which we hope the Conservative party, both in Ottawa and Ontario, will take note and mould their own actions accordingly

Re Questionnaire No. 3

Technical men throughout the Dominion are again reminded that they are being held responsible for the prompt return of Questionnaire No. 3, which is now in process of distribution to industrial concerns in the various provinces. In the June 1 issue of the Electrical News we outlined the general scheme of handling the questionnaire, and indicated, province by province, the different organizations that have undertaken the work. The success of the whole matter is, however, in the hands of technical men as individuals. What will you do to help? Will you undertake to attend to any one special section of territory, one town, or even one single firm, to see that the significance of this questionnaire is explained and the correct replies sent in? Do not wait to be asked, or for the other fellow to do it. Send in your name to the organization in charge in your province, and say just what you are prepared to do. Don't wait till to-morrow even.

The collection of this information is real war work, and will conceivably be a factor in ending the war a little sooner. Sit down right away and think out who there is in your vicinity that you can use your influence with—then write to-night to the "nearest office" of the organization in charge.

It's a real "bit."
It needs doing to-day.
You can do it.
WILL YOU?

Civic Investment Issue First Report

The first report issued by the Civic Investment and Industrial Company, of Montreal, which is a holding company controlling the Montreal Light, Heat and Power Company and the Cedars Rapids Manufacturing and Power Company, has just been made public. The report covers the nine months ending April 30, 1917, and shows that, during that time, the gross revenue totalled $6,783,839; operating and maintenance expenses and taxes amounted to $2,866,316; $675,000 was set aside for depreciation and renewal reserve, leaving a net revenue of $3,242,523. From this sum fixed charges of subsidiary companies to the amount of $765,513 had to be deducted, leaving a total net income for the nine months amounting to $2,486,009. Dividends to the amount of $1,903,395 were paid, leaving a balance of $582,614.

In his address the president, Sir Herbert Holt, pointed out that, though the statement was a particularly good one, it had actually been reduced by reductions in the price of gas and electricity during the past year to the amount of $667,917, which, he explained, went into the pockets of the Montreal public. Rates were 50 per cent. cheaper than those ruling in Toronto. In addition he understood that one of the supply concerns in that city had not paid any municipal or provincial taxes, nor had they subscribed to any war fund. Civic Investment, on the other hand, had subscribed liberally to the Dominion war loan, the patriotic fund, the Red Cross, and others. The report stated that Civic Investment output for the past year had amounted to 1,000,000,000 kw.h. No construction work was contemplated except what would be necessitated by the installation of two more 10,000 horse-power units at the generating plant at Cedars Rapids.

The Ontario Power Co. Purchase

By the purchase of the generating plant of the Ontario Power Company, Niagara Falls, Ont., the Hydro-Electric Power Commission of Ontario have acquired the largest generating plant in Canada. The capacity of this plant is in the neighborhood of 175,000 horse-power.

The agreement, briefly, amounts to the assumption by the Ontario Government of a bond issue of $14.699,000, the payment by 4 per cent., 40-year debentures at 80 per cent. of its par value for $10,000,000 of capital stock, and the assumption of all Canadian and United States contracts. The financial obligation thus amounts to $22,669,000, on the supposition that all the common stock is turned in, and the contracts include the commission's own contract for 100,000 horse-power, as well as a contract with the Ontario Transmission Company, which distributes throughout the Niagara Peninsula, for 60,000 horse-power. There is also assumed a contract for the supply of 60,000 horse-power on the United States side of the line. It will thus be seen that the Ontario Power Company held contracts for supplying up to 220,000 horse-power, which necessitated the purchase of a considerable quantity of power. This, by an old agreement, is being obtained from the Electrical Development Company. The agreement for the supply of 60,000 horse-power to the United States terminates in 1950; the price received is $12.50 per horse-power. The United States company own their own distribution system.

The Ontario Commission is therefore distributing at the present time in the neighborhood of 300,000 horse-power. This is made up chiefly of the 220,000 horse-power obligation assumed from the Ontario Power Company, 50,000 horse-power purchased from the Canadian Niagara Power Company, the generating plant at Eugenia, the Severn River plants, and the numerous developments recently taken over in Central Ontario from the Electric Power Company.

Electro-Culture and Crop Production—Results During 1916

The Electrical Review publishes results of experiments carried out during 1916 at the Lincluden Mains Farm, Dumfries. The experimental crop, as in 1915, was oats; the soil of the field was a sandy loam, and the field (of nine acres) had been in pasture without manure for the three previous years, having been grazed over.

One acre was chosen as the electrified area, and two half-acres as controls; one control was near, but measurement showed that it received only a slight discharge, while the other control was out of the track of the prevailing westerly winds, and at such a distance that even with north-west winds it received practically no discharge.

The difficulty of confining the discharge to the area to be electrified is much reduced by keeping the wires low, and an earthed screen of wire netting was found unnecessary, owing to the low position of the wires and the position and distance of the controls.

The overhead discharge was applied by means of a series of 21 wires running parallel to the short sides of a rectangular area (88 yards by 55 yards), the wires being about 4½ yards apart, and supported at their ends about 7 feet from the ground, though towards the end of the experiment they sagged down to 6 feet at the centre.

The current supplied through the primary circuit was about the same as in previous years, i.e., 3 amperes at 50 volts, but owing to the lower level of the wires (7 feet, as compared with 10 feet in 1915 and 15 feet in 1914), and the closer arrangement of the wires (13½ feet, as against 15 feet in 1915 and 20 feet in 1914) the intensity of the discharge received by the crop was much increased. (The intensity of the discharge received can be increased by (1) lowering the wires; (2) reducing the distance between the wires; and (3) reducing the thickness of the wires. No. 24 gauge silicium bronze wire was used.)

Immediate Results

The crop was sown on March 27, appeared above ground on April 13, and the discharge started the next day; by May 16 the electrified plants were markedly deeper green in color and taller, and later measurements of the average heights of plants were as follows:

	Electrified.	Control 1.	Control 2.
June 18	19 in.	14 in.	12 in.
June 25	24 in.	19 in.	18 in.
July 3	32 in.	21 in.	20 in.

After the latter date it was not possible to obtain measurements without damaging the crops.

It was clear that the electrification extended some little distance from the trial area, for the height of the crop round the area was above the average, and gradually decreased with distance.

The discharge was continued until August 17, being used only in the day time and discontinued during actual rain; the discharge time was 848 hours during the season.

It was generally agreed that the oats were the finest crop in the district; unfortunately, heavy rainstorms toward the end of August caused damage to the crop, and loss of grain occurred before harvesting. The yields obtained were as follows:

	Grain.	Straw.		
Electrified,	2,637 lb.	Quality 1,	1,942 lb.	
Area, 1 acre.		Quality 2,	695 lb.	4,924 lb.
Control (1),	840 lb.	Quality 1,	630 lb.	
½ acre.		Quality 2,	210 lb.	1,218 lb.
Control (2),	924 lb.	Quality 1,	714 lb.	
½ acre.		Quality 2,	210 lb.	1,401 lb.

The electrified area, as compared with the controlled areas, gave an increased yield of 873 pounds of grain, or 49 per cent., and 2,305 pounds of straw, or 88 per cent.

The farmer who works the land estimates the loss from climatic conditions at 420 pounds. If this is accepted, the grain increase works out at 73 per cent. In 1915, when the oats were subjected to a weaker discharge, a 30 per cent. increase occurred in grain and a 58 per cent. increase in straw.

The authors refer to the difficulty of accurately estimating the financial results; but based on market prices in the district, the increased value of the crop works out at £6 7s. per acre.

The energy used—about 130 kw. hours—if reckoned at 1d. per unit, works out at only 11s.

The cost of an installation on a large scale cannot be predicted at present, but the profit shown above would permit of a heavy expenditure on an installation.

Lasting Effect

The authors conclude by pointing out that a new and important aspect of the problem has been disclosed by the discovery that the application of the discharge one year may increase the size of the crop the next year—i.e., there may be a marked after-effect. The difference between the crop of clover hay produced in 1916 on ground previously electrified and that on the non-electrified area was very marked, and an increased weight of crop was obtained from the electrified area. Two views show the areas in question, with the second crop of clover on the hay stubble in September; the first crop was cut in July.

If in addition to an immediate increase of the treated crop a succeeding crop is benefited, it is obvious that the agricultural value of the application is very much enhanced.

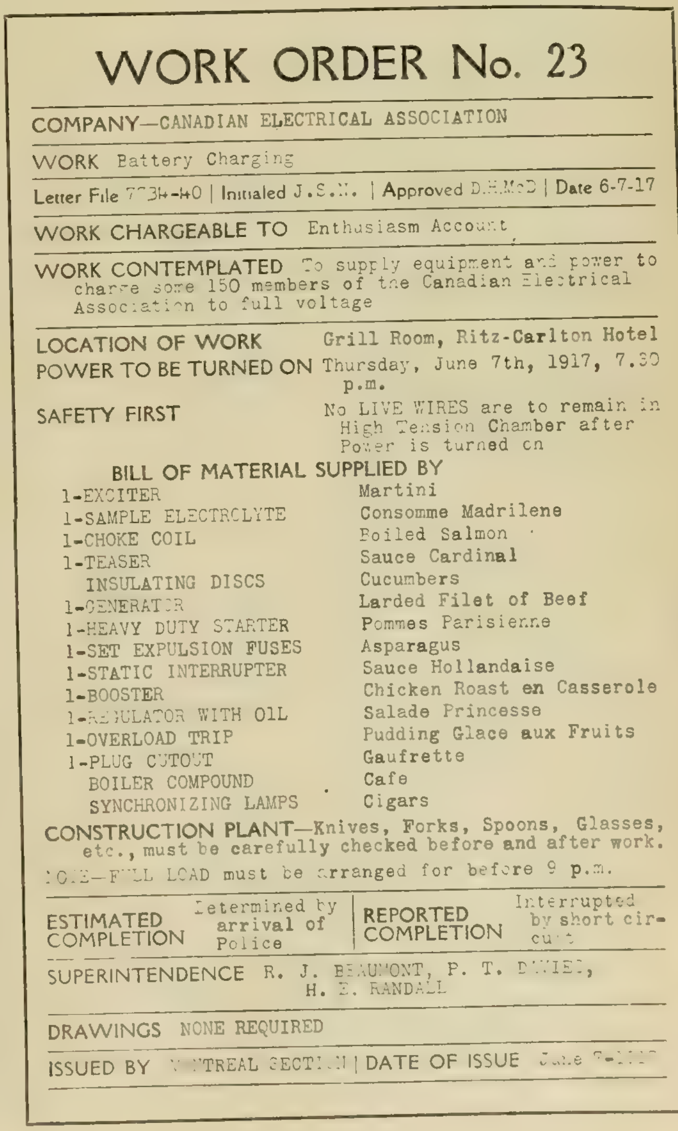
Much, however, still remains to be investigated in connection with the electric discharge; the conditions under which the effect is produced—its relation to light and humidity; the most suitable strength of discharge has to be discovered, as the experiments suggest that with a greater intensity of discharge still bigger yields might be obtained. Manurial conditions and effect of soils have to be investigated; also electrical engineering problems. The question of the manner in which the electric discharge influences the growth of a crop is still quite unsolved.

Westinghouse Gives Up British Control

A newspaper despatch states that negotiations for the sale, by the Westinghouse Electric and Manufacturing Company, of its stock control in the British Westinghouse Electric Company, which in turn carries control of the French and Italian Westinghouse companies, have been completed. It is announced that a holding company will be organized in Great Britain, backed by English capital, for the purpose of buying the shares and debenture stock now held by the United States Westinghouse Company.

Complimentary Dinner by Montreal Section to Delegates at C.E.A. Convention

—The Menu—



WORK ORDER No. 23

COMPANY—CANADIAN ELECTRICAL ASSOCIATION

WORK Battery Charging

Letter File 7734-40 | Initialed J.S.M. | Approved D.H.McD | Date 6-7-17

WORK CHARGEABLE TO Enthusiasm Account

WORK CONTEMPLATED To supply equipment and power to charge some 150 members of the Canadian Electrical Association to full voltage

LOCATION OF WORK Grill Room, Ritz-Carlton Hotel

POWER TO BE TURNED ON Thursday, June 7th, 1917, 7.30 p.m.

SAFETY FIRST No LIVE WIRES are to remain in High Tension Chamber after Power is turned on

BILL OF MATERIAL	SUPPLIED BY
1-EXCITER	Martini
1-SAMPLE ELECTROLYTE	Consomme Madrilene
1-CHOKE COIL	Boiled Salmon
1-TEASER	Sauce Cardinal
INSULATING DISCS	Cucumbers
1-GENERATOR	Larded Filet of Beef
1-HEAVY DUTY STARTER	Pommes Parisienne
1-SET EXPULSION FUSES	Asparagus
1-STATIC INTERRUPTER	Sauce Hollandaise
1-BOOSTER	Chicken Roast en Casserole
1-REGULATOR WITH OIL	Salade Princesse
1-OVERLOAD TRIP	Pudding Glace aux Fruits
1-PLUG CUTOUT	Gaufrette
BOILER COMPOUND	Cafe
SYNCHRONIZING LAMPS	Cigars

CONSTRUCTION PLANT—Knives, Forks, Spoons, Glasses, etc., must be carefully checked before and after work.

NOTE—FULL LOAD must be arranged for before 9 p.m.

ESTIMATED COMPLETION Determined by arrival of Police | REPORTED COMPLETION Interrupted by short circuit

SUPERINTENDENCE R. J. BEAUMONT, P. T. DAVIES, H. E. RANDALL

DRAWINGS NONE REQUIRED

ISSUED BY MONTREAL SECTION | DATE OF ISSUE June 7-1917

A Confident Optimism Among Prominent Officials Throughout Central and Western Canada

Building Upon a Firm Foundation—Decided Betterment Already in Evidence—Electric Power Guarantee of Future

The value of an optimistic expression of opinion depends largely upon the person who expresses it. A real estate dealer, for example, is an optimist by profession; since this is his perpetual attitude of mind, one has no comparative data upon which to form a judgment. The other extreme is to be found among technical men—men trained to anticipate the effect of every move they make, to foresee and guard against all unfavorable factors. Such men are, of necessity, cautious and guarded in their statements, and their inclinations are towards conservatism.

It is when a conservative becomes an optimist that the average citizen is safe in following the lead.

Just below we are reproducing a number of letters, or extracts of letters, from men prominent in Western Canadian technical electrical matters. These letters came in reply to an enquiry regarding business conditions in the West and the prospects for the immediate future. Without exception the letters say "improving." There is no wild enthusiasm, but something, to our way of thinking, much better—a quiet, confident tone of conviction that now, at last, the foundation of a permanent development has been laid so carefully that it will carry a superstructure of any size. Perhaps the building will go up a little bit slowly for the most impatient Westerners, but the main thing is that the work is going forward steadily.

The fact seems to be that Western Canada is so brim full of all the elements that go to make up a big industrial movement that it is difficult to see how such a movement can be long delayed. The optimism of the Western conservative thinker is not born of hope, but is, rather, the answer to his own arguments. It is the inevitable conclusion following the careful investigation of actual conditions. What are the essentials for industrial prominence—farm products, minerals, power, timber? The West has them all—in abundance. The only lack is men—population. If that follows the cessation of war, Western Canada will surely see development on an entirely sound basis and still equal in magnitude to anything she has experienced in the past.

And what does this mean to electrical men? Everything. Where is there an industry to-day that is not dependent upon electrical energy? Think of its increasing use in every line of trade. Progress commercially means progress electrically. The next Western "boom" will be an electrical boom—a demand for every kind of electrical material. It is with a very great degree of satisfaction, therefore, that we reproduce the confident expressions of a number of to-day's leading thinkers among electrical men in our Western provinces:

British Columbia

New Westminster, B.C.

Editor Electrical News:

Much improvement has taken place in respect to the use of electricity during the past few months, and indications are not lacking for a return to the prosperous period of 1909-10-11.

Particular mention may be made to the renewed activity of the lumber mills, which have been slack for some time, and erection of new plants, together with the reopening of mills which have been shut down for some time. As this industry is chiefly operated by electricity, it means much to the electrical trade.

The impetus given shipbuilding on the coast is already proving beneficial, machine shops, foundries, boiler works, etc., reaping much advantage from this industry, and incidentally the electrical business comes in for its share of the work. Strong hopes are entertained that shipbuilding will become one of the largest industries in the province, and everything is being done to foster trade to eastern countries.

The Land Act of the province is receiving some attention, and the proposal to bring settlers from remote districts, with the view to forming community settlements, will have a great effect on the electrical business, as it is only natural to expect that many industrial concerns will be the offshoot of this move, such as jam and preserve factories, evaporating plants, etc., and, as electrical power is being used largely by farmers and dairymen now, the closing in of the sphere of activity will prove invaluable from our standpoint.

I have no hesitation in stating that the future of this province, with its mining, lumber, fishing, shipbuilding, and farming interests, is very bright, and that a turn in the tide of affairs has set in.

Yours truly,
John C. Digby,
City Electrician.

* * *

Vancouver, B.C.

Editor Electrical News:

General conditions throughout Western Canada have shown decided improvement, especially within the last few months. The consensus of opinion is, I think, that this improvement is permanent and based on sound economic principles.

Considerable impetus has been noticed in practically all branches of industry throughout the province. Much attention has been given to the development of natural resources, and the Legislature is fully alive to the fact that we have arrived at a time when more interest is going to be devoted to unearthing the hidden wealth of the province than has been evident for many years past. The Provincial Government has within the past few days voted a large amount of money for mineral survey and development work. The electrical industry will naturally benefit to a great extent by the harnessing of water-powers necessary for the hydro-electric development of many of the mines.

Intimation has recently been received that a group of financiers propose to erect in the province a big steel works and cooking ovens, which, with mining investments and developments, will mean an expenditure of over $10,000,000.

The shipbuilding industry, which is a large consumer of electric current in its operations, is rapidly extending in respect of the construction of both steel and wooden ships.

There is a constant demand for lumber, and the mills, many of which are electrically operated, are practically running to capacity.

The use of electricity for domestic purposes, such as electric ranges, vacuum cleaners, and other labor-saving appliances, is increasing to an appreciable extent, and we are sanguine that a very general demand for such appliances will be made in this direction during the next two or three years.

We have also advocated and demonstrated, with successful results, the use of electric current for agricultural purposes, and we feel that there is very great opportunity for the electrical industry in this respect.

Conditions due to the war have naturally had a depressing effect on business in the province generally, inasmuch as British Columbia has participated only very little in the contracts awarded by the military authorities; this being the case, it cannot be expected that the improvement which is now evident will be of more than a gradual growth. However, when the war is over I think that British Columbia is so situated that the revival of business activity will be more marked here than in any other part of the Dominion, as we will not be adversely affected by the loss of any war business such as will be keenly felt by many of the large industrial centres in Eastern Canada.

British Columbia has also been handicapped by the lack of shipping, but with the activity displayed in this industry this handicap should be greatly lessened in the near future.

The Vancouver harbor commissioners have recently outlined their scheme for a general improvement in harbor facilities, and to this end have secured a grant of several million dollars from the Dominion Government.

An area of land, consisting of approximately forty-two acres, has been reclaimed by the harbor commissioners in False Creek. This is plotted out into sites for industrial plants, and will be leased at nominal rentals. A network of railway lines is being laid down on the reclaimed land, so that the plants will have both rail and water facilities. Our electric power distribution lines are also being erected on this site, as probably all the plants operating thereon will do so by electric power.

The establishment of industries such as these and the encouragement which they will receive from the provincial and municipal authorities will result in a steady growth in conditions on sound, business lines.

Yours truly,
George Kidd,
British Columbia Electric Railway Company.

* * *

Vancouver, B.C.

Editor Electrical News:

I personally feel that the war conditions are at last bringing to Vancouver a development along its proper lines somewhat sooner than could have been expected under other conditions. What may happen after the war is over no one can tell, but I feel that nothing can prevent a very steady and a very large development on this coast.

During 1916 there was a gradual but steady improvement in business conditions in British Columbia, and it was felt that the industrial revival in the State of Washington would before long have its counterpart in this province. The unseen forces which have been at work for some time are now having visible effect, and seem to be bringing to Vancouver an era of great industrial activity, which it is hoped will not be merely a passing phase resulting from the war, but will result in the permanent establishment of Vancouver as a large shipping port and an important industrial and distributing centre.

"The first sign of revival in British Columbia came from the copper mines, in which there has been the greatest activity during the past two years. The mines and smelters of the Kootenay District have had a larger production than ever in their history before, and the establishment of the electrolytic zinc refinery by the Consolidated Mining and Refining Company of Canada, at Trail, is one of the most important steps that has been taken in mining in the West. The Kootenay Light and Power Company (whose organization has been largely responsible for the economical mining development of the district) supplies all the power for the mines and smelters, and has made large increases in the capacity of its plant to take care of the zinc refinery.

The Hedley Gold Mining Company has its own steam and hydro-electric plant and at Princeton and Merritt other important copper properties are in progress of development, and may shortly require large amounts of power.

Large Copper Production

About thirty miles north of Vancouver is located the Britannia Mine, which has increased its plant until it is now one of the largest copper producers in the British Empire This mine has developed power for itself, partly by water and partly by steam, but it will doubtless find it economical to buy central station power as its demand further increases.

The Granby Smelter, at Anyox, near Prince Rupert, about 550 miles north of Vancouver, is a very large producer, and is steadily increasing its capacity. This property develops its own power, both by water and steam.

A new mine on Surf Inlet, on one of the islands to the north of Vancouver Island, has established its own hydro-electric power, and is now being rapidly developed.

The Hazelton District, on the Skeena River, is showing increasingly good promise, and much exploration work is being done in various parts of the province.

Owing to the high price and the increasing scarcity of fuel oil, attention is being turned to the use of pulverized coal fuel for steam generation, as well as for other heating purposes, and the output of the coal mines is therefore likely to be largely increased.

The pulp and paper industry is developing rapidly. The large plant at Powell River has been working to its full capacity for a long time. The British Columbia Sulphite Mills, on Howe Sound, are making important developments, and the plant at Ocean Falls has been greatly enlarged.

All these pulp and paper mills are located on deep tidewater, where they have developed their own water-power very economically, and can ship their product on ocean-going vessels all the year round.

Shipbuilding is now in a fair way to being established in Vancouver and Victoria on a permanent basis. A number of wooden ships, with auxiliary Diesel engine motor power, are being built. All these are five-masted schooners, three vessels having already left the ways, and a further seven will be in the water by the end of the year.

At the Wallace Shipyards, in North Vancouver, a 5,000-ton steel freighter is under construction, and J. Coughlan & Sons have contracts for the building of six 8,800-ton steel freight steamers, and have already laid one keel and prepared the ways for two others.

The Dominion Government is now making arrangements for the construction of a number of steam freighters, with wooden hulls. These vessels will require engines, boilers, winches, and other auxiliary equipment, much of which will be built in Vancouver, and the large demand for small angle bars and shipbuilding sections has led to the establishment of two small rolling mills.

All the machine shops, foundries, and structural steel plants in Vancouver are full of work, and this city is now a very busy place indeed.

Lumber Industry Active

The lumber industry (the great staple of Vancouver) is in the midst if the most active period of its history. Prices are high, and the demand for lumber, both for the prairies and for the shipbuilding, will tax the mills to their capacity.

In connection with the lumber industry the woodworking factories manufacturing boxes, etc., are all increasing their capacity to meet the demand, and most of the sash and door factories are quite busy.

The fishing industry, next only in importance to the lumber, is growing every year, and calling for the establishment of new canneries, new refrigerating plants, more shipping facilities, and the construction of more boats.

In spite of the difficulty of securing tonnage, the port of Vancouver sees more large ocean-going vessels coming in and going out than in any previous year, and the Canadian Pacific Railway has found it necessary to make important increases in its docking facilities, while the Dominion Government last year completed and opened a large dock in connection with the grain elevator, which is designed on the lines of those in Montreal.

An electric steel furnace for the manufacture of steel castings is now under consideration by two of the foundries, and one of the small rolling mills has already placed an order for a five-ton Rennerfelt furnace. There is an immediate opportunity for a very considerable development with electric furnaces.

The conditions on the coast of British Columbia are exceptionally good for the establishment of a large nitrate plant, and it is hoped that before long the Dominion Government may see their way to bring this about.

All these growing industries are absolutely dependent upon electricity. Some of them develop their own power, but most of them require power from central station sources.

There is at the present time a large surplus of central station power immediately available in Vancouver for the establishment of any new industry, but it is not unlikely that in a much shorter time than most people believe this surplus of supply will be used up, and further developments will have to be made.

Yours truly,
R. F. Hayward,
General Manager Western Canada Power Company.

* * *

Victoria, B.C.

Editor Electrical News:

As to the future, British Columbia has certainly great possibilities ahead of it. Mining has and is developing at a very rapid rate, and a large number of mines that were not considered profitable before the war are, I understand, now being worked at a very fair profit. Whether these developments will continue after the war is over it is impossible for me to say.

The electrification of some of the mountain divisions of the C.P.R., as you are no doubt aware, is being considered, but I understand this will not be undertaken, if at all, until after the war is over, and when financial matters have improved. A great improvement in the lumbering industry of the province has taken place.

This province has a tremendous amount of water-power as yet undeveloped, which no doubt will ultimately be utilized for the generating of power, especially in connection with the pulp and other industries. Generally speaking, I should say that the outlook for electrical development on the coast is fairly promising, but I do not look for any great expansion at the present time.

Yours truly,
C. H. Rust,
City Engineer.

Alberta

Calgary, Alta.

Editor, Electrical News:

"There is every indication that general business conditions are improving in the West, but to what extent this may continue is, in my opinion, problematical. It is true we are getting down to a sounder, saner basis, and there seems to be a strong and growing public opinion in favor of the development of the natural industries of the country, rather than the promotion of boom-time or speculative enterprises.

"Recently the question of developing large coal areas some fifty miles southwest of the city of Calgary has been brought before the Calgary Board of Trade. The coal is said to be of fine quality (semi-anthracite) and will stand storage. These coal lands should be developed in the interests of the prairie provinces immediately to the east. The plans call for the construction and electrification of a line to the said coal areas, but the scheme is being retarded by lack of capital to carry it out. There can be no question but that the development of these mines would be of immense economic value to the country and would, by the construction and operation of an electric line, create a demand for electrical equipment.

"As far as the electrical industry in this city is concerned, I look for a steady growth. The city electrical plant is in a position to distribute another 10,000 horse power without any large addition either to machinery or plant.

"There was an increase, in the maximum demand, of 2,000 horse power for the year 1916, compared with 1915, which is due to the general improvement in business and the extension of the milling industries. Brick and tile industries, which had grown to considerable proportions prior to 1914, are for the most part now closed down, as are other industries which relied solely on the building trade. Although it must be noted that conditions in the lumber, sash and door trade, are improving, particularly in the country trade."

Yours truly,
A. G. Graves,
Commissioner of Public Utilities.

* * *

Edmonton, Alta.

Editor, Electrical News:

"Below you will find a statement showing the earnings of the utilities of the city of Edmonton for the year ending December 31st, 1917:

Utilities—Statement for 1916

	Surplus on operation and maintenance	Surplus over all charges including depreciation
Electric light and power	$196,255.16	$64,788.82
Waterworks	173,220.90	24,410.04
Telephone	167,965.95	9,570.84
Power house up to June 30, 1916)	119,468.34	39,430.71
Street Railway	132,755.88	*119,597.66
	$789,666.23	$138,200.41
* Deficit		119,597.66
Surplus over all charges on all utilities		$18,602.75

"The above figures speak for themselves. It will be noted that, taking the utilities as one corporation, they show a surplus of $789,666.23 over and above operation and maintenance expenses, and a surplus of $18,602.75 over all charges.

"In this connection it may be pointed out that a private corporation does not lay aside what is known under municipal ownership as a sinking fund, to retire debentures at the end of a certain number of years. It would be sufficient for a private corporation to pay to the shareholders a moderate rate of interest on their shares and lay aside a certain amount for future contingencies, but utilities operated by a municipal corporation are not only required to pay all operating, maintenance and depreciation charges and interest, but are also compelled to put aside a large sum of money each year into the sinking fund, for the redemption of the capital moneys invested, which is no doubt the safe thing to do, but when comparing municipal ownership with private ownership, this fact should be borne in mind.

"The Street Railway has a surplus of $132.755.88 over operation and maintenance expenses, and is earning 4 1/3 per cent. on the capital invested, and showed a betterment of $16,161.05 over the year 1915, which is considered satisfactory.

Yours truly,
A. G. Harrison,
City Commissioner,

* * *

Edmonton, Alta.

Editor, Electrical News:

"I have just returned from visiting Calgary, Regina, Saskatoon and Winnipeg, and find very favorable conditions in all four places, especially Winnipeg. In each province conditions generally are improved throughout the smaller towns in particular, largely due to the high price of all food commodities, especially wheat. I do not foresee any decided development in Edmonton for the next year or two. However, we are steadily improving and the revenue of the light and power department is equal to-day to that of 1912; but this is due to increased revenue received from residential lighting. As you are aware, the western cities were all over-built, I think possibly Edmonton more so than some of the other cities in the west. Consequently there will be no construction work worth speaking of until we decide to complete our underground scheme in the business area of the city. I am optimistic regarding the future of Edmonton and district, but due to the present war conditions, the city will feel the depression for some time to come.

I am enclosing herewith copy of our annual report and hope same will prove of interest to you in writing up your annual number of the Electrical News.

Yours truly,
A. W. Ormsby,
Supt. Light and Power Dept.

Saskatchewan

Saskatoon, Sask.

Editor, Electrical News:

"When one speaks of the electrical industry one's mind naturally wanders back to the question of prime movers. Now, in Southern Saskatchewan, we are not in the fortunate position of say, Ontario; we have no Niagara, but in place of a Niagara, we have vast deposits of lignite. This lignite is of a rather low grade, having in the neighborhood of 20 per cent. moisture on an average.

"Having realized the problem we are up against, we set to work, and I am glad to say that to-day we can show some results. I am referring now to the burning of this lignite. By making certain alterations to our furnaces we are now in a position to produce, almost, if not quite, pound for pound of steam per pound of coal against the coals having a lower percentage of moisture content mined in the east and south.

"The whole lignite question has been investigated very fully by Mr. Darling, for the Saskatchewan Government, and his report proves conclusively that we can produce from our lignite, electrical energy at Niagara rates in this province; also, the development of that energy at these rates, coupled with the development of other industries, such as nitrate fertilizers, analine dyes, etc., will open up great industrial possibilities.

"During the past year there has been developed and patented in this province, a method of gas production by destructive distillation of straw. The method is simple, and the apparatus capable of such cheap production that in the very near future I expect to see every farm of any size in the prairie provinces producing its own gas.

"Now that free wheat has become an accomplished fact, and sample markets will be established here very shortly, this indicates that there will be a large increase in the milling industry in the prairie provinces.

"Northern Saskatchewan, so far as the city dweller is concerned, has been a closed book, but this past year we have been getting reports that are, to say the least, very gratifying. We have reports of claims staked out and fabulous prices offered. These claims include gold, silver, coal, and iron. In one particular case, one copper claim has been sold for four and a half million dollars. In another instance, a gold claim, it is reported that there are forty million dollars already blocked out. So far as that is concerned, we have only reports to go by, but one fact stands out as clearly indicating the value of the claim, that one and a half million dollars were offered for this particular claim and it was refused.

"I understand that behind these prospecting and development schemes, the capital is largely Canadian. There are two large American financial interests also at work in the same district. I mention these facts simply to emphasize the possibilities for the development of the electrical industry of this province. The development of any of the above mentioned lines means development for the electrical industry.

"I have already mentioned Southern Saskatchewan as having no Niagara. I am glad to be able to say, however, that the northern portion of the province has not only one Niagara, but several, some of them within two hundred miles of this city. Now, given these facts, it does not require a seer to prophesy that just so soon as the war is over, the industrial development of this country, which means the electrical development, will be very rapid.

"To come down to this particular city (Saskatoon), before closing, I would just like to remark that our output for the first four months of this year is greater by 20 per cent. than for the same period of any year in the history of our utility.

"The electrical contractors here are all as busy as they can be, and there is no idle labor. The building contractors have a large program before them, and in fact, every indication points to a record year."

Yours truly,
E. Hanson,
City Electrical Engineer.

* * *

Moose Jaw, Sask.

Editor, Electrical News:

"If general conditions in Moose Jaw are representative of those throughout Western Canada, it is evident that the West has rapidly recovered from the slump which followed the "boom" days of 1910, 1911, and 1912, and in the process of recovery has dropped many of the unhealthy or undesirable features so prominent in all lines of business during the "boom" days. All "get rich quick" speculation has been eliminated and real development has now commenced upon a sound, legitimate basis.

"It is the general opinion of leading business men that prospects are good, particularly for the period following the cessation of the war.

"The growth and development of industries best adapted to this particular section of the country is already in evidence by the activity in the milling business. The Robin Hood Milling Company of Moose Jaw and Calgary have found it necessary to increase the capacity of their Moose Jaw flour and oat mills by over fifty per cent., and work has already been commenced upon these extensions, in which electric power to the extent of at least 600 horse power will be utilized.

"Another local industrial concern, who have been engaged at munition work during the last two years, are turning their attention to the manufacture of retorts for producing a high grade gas from straw, which business will no doubt develop rapidly, as this product gives the farmers of the prairies the means of supplying their own heat, light and power from the straw, which has heretofore been wasted. In this plant also a large amount of electric power will be employed.

"Other industries are springing up and prospects for an increased use of electric power are more encouraging than at any time in the past.

"The City Light and Power Department during the year 1916 exceeded all previous records as regards both output and number of consumers, which shows that the population has returned to its previous high record. Houses are in demand and considerable building has started or is contemplated in spite of the present high cost of labor and material. The Light and Power Department will spend about $25,000 this year on line extensions and street lighting.

"The use of electricity in the home is growing rapidly, and a good demand for electric ranges and appliances has been created.

"There is little doubt that industrial development will be rapid and along broader lines, and that electric power will play a more important part in this development than formerly."

Yours truly,
J. D. Peters,
Electrical Superintendent.

Manitoba

Winnipeg, Man.

Editor, Electrical News:

"As you may readily believe, it is not a difficult task for a Westerner to write in an optimistic vein concerning the future of this country. The following remarks, however, are the result of careful thought and logical deduction, although the present war has detracted largely from the usefulness of precedents on which any definite conclusions can be based.

"Although there has been a decided improvement in the electrical field in Western Canada during the last twelve months it should be emphasized that we have not in the same measure recovered the ground lost through the outbreak of war in 1914, as have the Eastern provinces. It is not exaggerating to say that the turnover of electrical goods in Western Canada to-day is less than one-third of the business which was being handled in the year previous to the war. It is quite true that 1916 showed a marked improvement over 1915, but it will be many years, in my opinion, before we see the same turnover in the electrical business in the West as occurred in 1912, which was our 'banner' year.

"Naturally the utility companies have not felt the setback to the same extent as the manufacturers, nor will they show the same percentage of increase in their earnings as the manufacturing concerns will undoubtedly accomplish after the war is over.

"I look to a steady and gradual improvement in conditions. The apparatus end of the electrical field has been showing marked improvement lately, which indicates that there is some new capital being invested in the West for industrial enterprises. There are two industries which are showing particular activity in this connection at the present time. I refer to the pulp industry and the grain elevator projects. There are several water power sites, plans for the development of which have already been made, but which are undoubtedly held up owing to the insuperable difficulty at the present time of financing these large undertakings. This condition will probably obtain until the war is over.

"Speaking generally, Western Canada must place its hopes for the future on increased immigration, which is already showing a marked improvement over last year. There is no reason for being pessimistic; on the other hand, there is nothing to be gained by unwarranted optimism. A slow and gradual recovery, in my opinion, will best serve the interests of the West. Most Westerners deprecate the so-called "booms," which have visited us in the past. Business men of mature judgment and experience are in accord in wishing to see no return of this unhealthy and fictitious element in our business life."

Yours truly,
J. G. Glassco, Manager,
Light and Power Department.

Western Ontario

Fort William, Ont.

Editor, Electrical News:

"While we have not benefited to any great extent from the munitions and war business, we have been active in our regular lines, and conditions for the future look very promising. As you are aware, we are first a shipping and bulk breaking point, for the whole of Western Canada, in grain, coal and other commodities.

"As a bulk breaking point, and the Canadian Head of the Lakes, we are strategically located for the manufacture of raw materials into finished products, for the Eastern, Western and American trade to the south of us.

"We have great possibilities before us in the further development of our agricultural, mineral, pulp and timber resources, fisheries, etc., with which the adjoining districts abound.

"In minerals we have iron, pyrites, copper, silver, gold, zinc, molyodenite, silicates, talc, building stone, marble, clays and shales, marl, potash, kaolin, etc.; some of which are actively developed, while others afford great opportunities for the investor.

"The Port Arthur Shipbuilding plant has on order and under construction at the present time, some 22 canal size, steel vessels, for the lake and ocean trade.

"The Port Arthur pulp and paper mills are under construction, and negotiations are pending for the location of other mills in this vicinity. The superior advantages of three transcontinental railways and numerous rivers flowing into Lake Superior, tapping immense pulp forests, combined with an abundance of water power, has attracted a great deal of attention from pulp and paper interests, looking for opportunities for expansion.

"Other industries are active, and a number of large terminal and private grain elevators are under construction, making, when finished, our total capacity in elevators for Port Arthur and Fort William some 50,000,000 bushels, which makes us probably the leading grain port in the world.

"The net tonnage of this port for 1916 was nearly 10,000,000 tons, or practically double that of 1915.

"Our business people and commercial houses, and various industries report prosperous conditions, and are optimistic of an even greater prosperity, following the return of our soldiers and settlers to Western Canada, and the restoration of normal conditions."

Yours truly,
W. L. Bird,
Manager and Secretary,
Kaministiquia Power Company.

Senator Nicholls Urges Conserving and Increasing Our Domestic and Overseas Trade

Senator Frederic Nicholls, speaking to the debate on "Conservation of Canadian Trade," in the Senate on June 5, offered the following resolution:

> That in the opinion of this Honourable House, it is expedient to appoint a committee to inquire into and report upon the best method or methods of conserving and increasing our domestic and overseas trade to the end that our present prosperity may not unduly suffer when the stimulus resulting from orders for munitions and other war supplies is removed, and that the committee consist of Hon. Messrs. Beaubien, Edwards, McLennan, Dandurand, Gillmor and the mover.

Senator Nicholls said in part: "Presently this country is, notwithstanding the war, but rather as a result of the war, experiencing a period of great prosperity. Prior to the commencement of the war Canada borrowed about three hundred million dollars each year from Great Britain, partly to pay interest on debts already contracted, and partly to develop our resources and for industrial investments. When the tocsin of war first sounded this source of supply was shut off immediately. For a short period trade and finance were severely disorganized, but the recovery was not long delayed, and our recent trade returns—and figures in the final analysis are what count—almost surpass belief. Quoting from the recent Budget speech of the Honourable the Minister of Finance, I may point out that during the first year of the war the revenue from all sources was about $130,000,000; it rose during the second year to $170,000,000; but for the year ended the 31st March last the revenue increased to $232,000,000. Our total war outlay since the beginning of hostilities is over $600,000,000, and is constantly increasing, and this expenditure has been met partly from revenue and partly from the proceeds of domestic loans, which have aggregated $350,000,000; and in addition our chartered banks have loaned to the Imperial Treasury over $150,000,000 to meet its commitments for munitions and supplies purchased in Canada.

Large Munition Orders

"It should be remembered, however, that a very large proportion of our prosperity is the result of extraordinary orders for war materials and supplies, amounting to vast sums, some estimate of which may be realized when I cite the fact that orders received by the Imperial Munitions Board alone amount at this time, in round figures, to about one billion dollars, and that of this sum about six hundred million dollars has already been disbursed to manufacturers in payment for munitions, and that engaged in this manufacture, directly and indirectly, there are over 250,000 workers. Further vast sums have also been paid out in the purchase of grain and other farm products, machinery, clothing, woollens, and an infinite variety of Canadian natural and manufactured products. It is because of this that my resolution draws attention to the absolute necessity of some action being taken to minimize, if at all possible, the sad check this country will receive when this source of income fails us. ?

"After the war ceases there will certainly be a period of disorganization, when the balance of trade, which for some time past has flowed steadily in our favor, will commence to recede. The countries now at war, however, particularly those that have been devastated in Europe, will require to expend immense sums in reconstruction, and will become customers of those countries which are most ready to supply the requirements promptly and at a reasonable price. In this country we have had little experience in either looking for or catering to an export trade, and if we desire to share in the volume of business that will be offering overseas we can make our preparations none too soon.

"Admitting that Germany in the past has built up her vast foreign trade largely through the help of the State, and admitting, as intimated by Sir Robert Borden, that State aid will be extended at even greater lengths after the conclusion of the war, it behooves us to consider whether we in Canada will leave to the individual the development of the foreign trade that might naturally accrue to Canada, or whether the government of this country will, in some form, undertake to assist in the development.

"Alexander Behr, vice-president of the Russian Chamber of Commerce, Moscow, in an article in the Journal of the Russian American Chamber of Commerce, makes the claim that:

> Germany's great increase in foreign trade up to the time of the war was due, more than to any other factor, to: first, the co-operation between her business men and her government; and second, the foresight and liberal methods of her bankers. Her banking facilities were shaped to suit conditions abroad, and her bankers came into direct and close contact with the people whose trade was sought. redit conditions were studied at close quarters, and business was done through the banks.

Banking System at Fault

"Next to intelligent assistance from the state it is obvious that in foreign trade the question of credit is the most important item, and in Canada our banking system does not tend to encourage the granting of credit for foreign exports other than on bills of exchange drawn against actual shipments, or commodities in elevators or warehouses. It is no criticism of the banks to draw attention to the fact that provision has not been made for a specific department for granting credits against exports of manufactured goods, for until now the necessity has not been urgent, and our manufacturers had not, prior to the war, developed to the extent that they were in a position to cater to the world's markets.

"Since the war, as I have pointed out, we have manufactured and shipped upwards of six hundred million dollars' worth of munitions alone, and I venture to say that the production of munitions is the most intricate, the most delicate, and the most precise class of manufacture that could be undertaken. It was an entirely new industry to Canada, and it is a credit to Canadian industry that in such a short time so many existing factories were reorganized and new ones established that have turned out such an immense quantity of munitions, and thereby brought to Canada so large a sum as six hundred million dollars for munitions alone. If the manufacturers, when the need arose, were able to accomplish such results I take it that they would be equally resourceful in manufacturing many other lines of goods for export that will be required by the European countries, we hope at no late date; but in order to bring this about some systematic method of state aid will have to be adopted.

Finance Committee Report

"That assistance in some form is necessary is not to be wondered at when we consider that even in Great Britain they have felt the necessity of grappling with the same problem. It has been admitted that the German national system of manufacturing for export, and system of banking facilities for export trade, were far in advance of those which obtained in Great Britain, and having these facts in view the British Government appointed a committee known as "The

Committee on the Financial Facilities for Trade.' A perusal of their report to the British Board of Trade is most illuminating. It is too voluminous to quote in extenso, but I bespeak your indulgence in quoting one or two of the salient clauses, one of which says:

> We recognize that the British manufacturers may be frequently in want of finance of a kind which a British joint stock bank with liabilities could not prudently provide, whereas the German banks in particular seem to be able to afford special assistance at the inception of undertakings of the most varied description, and to have laid themselves out for stimulating and promoting and to carrying them through to completion. We conclude therefore that there is ample room for an institution which, while not interfering unduly with the ordinary business done by British joint stock banks, by colonial banks, and by British foreign banks and banking houses, may be able to assist British interests in a manner that is not possible under existing conditions.

"The report further recommended that the main features of the Trade Bank should be as follows:

> It should not accept deposits at call or at notice.
>
> It should open only current accounts for parties who propose to make use of the overseas facilities which it would afford.
>
> It should have a foreign exchange department where special facilities might be afforded for dealing in bills in foreign currency.
>
> It should open a credit department for issuing of credits to parties at home and abroad.
>
> It should inaugurate an information bureau.
>
> Where desirable it should co-operate with the merchant or manufacturer, and possibly accept risks upon joint account.
>
> It should become a centre for syndicate operations, availing itself of the special knowledge which it will possess through its information bureau.
>
> It should receive government assistance.

British Government Favorably Impressed

"This report was not only seriously, but most favorably received by the Government, and, really at their suggestion, a British Export Bank, to be known as the British Trade Corporation, was promoted, and I have just received from Sir Albert Stanley, of the British Board of Trade, which is a department of the Government, a copy of the petition of the promoters, deed of settlement, and the royal charter of incorporation.

"Now, I think I have shown you that the great development of German trade abroad was brought about in a comparatively short time by an intelligent system of state aid, and by a system of banking specially developed for the promotion and extension of foreign trade. I have also shown that some of the keenest business men in England, members of a committee appointed by the British Government, have arrived at the conclusion that the only way for the British manufacturer to successfully compete after the war in foreign markets is to adopt a system somewhat similar to the German system, and their recommendations have been approved by the Government, and a royal charter granted to a British trade corporation, sympathetically in alliance with the Government, and with an initial capital of ten million pounds sterling.

"It is not my purpose to urge any definite line of policy, but I do urge that a committee of the House be appointed so that this important matter may be given serious consideration with the hope that after the evidence of those in this country best qualified to advise in this matter has been heard it may be possible to formulate some plan that may measurably attain a result so greatly to be desired.

A Trade Bureau

"It is a question whether it would be, or would not be, too radical a proposition for the Government to consider establishing a trade bureau, or a department, which would actually sell Canadian products in foreign markets and distribute the orders received amongst Canadian producers of natural and manufactured goods. Such a plan to my mind has much to recommend it. A government department as sales agent would carry more weight than an individual or corporate body could. It would also be able to finance trade credit on a much lower basis of interest, and thereby create a trade that it would be impossible for the individual to develop. The proof that such a plan is feasible is at hand. The Imperial Munitions Board is a department of the British Government and has practically sold to that Government hundreds of millions of dollars worth of munitions in bulk, and have distributed this vast volume of trade amongst hundreds of Canadian firms, thereby saving the country from a period of depression when normal trade was dormant, affording profitable employment to thousands of men and women, who otherwise might have been a charge on the community. For further proof the War Purchasing Commission, a department of the British Government, may be cited, where we have millions of dollars worth of Canadian products sold to allied nations, and the orders distributed broadcast to people who of their own initative would never have sold to a foreign market.

Constructive Statesmanship

"When the war ends we run great danger of a panic through disorganized trade conditions, unless the government lends a helping hand. Hundreds of millions of dollars have been spent in the construction of canals and the development of our waterways, and we are to be called upon to advance millions for the construction of good roads, but of what advantage are these public works unless an expanding trade calls for their utilization. A few millions to risk in the development of trade is not too much to expect from a government that has always stood for constructive statesmanship."

Current Notes

The City Council of Winnipeg, Man., have under consideration an expenditure of $12,000 for additional street lighting.

The Town Council of Kincardine, Ont., will secure estimates with a view to submitting a by-law to the people authorizing a contract with the Hydro-Electric Power Commission of Ontario.

The Town Council of Cobalt, Ont., recently decided to install a new telephone system upon the expiration of the franchise at present held by the Temiskaming Telephone Company.

The Toronto Street Railway will construct a branch line, to run from the east end of the Queen Street bridge along the east bank of the Don River to the Ashbridge's Bay industrial section.

The Light, Heat and Power Commission of St. Thomas, Ont., have contracted to supply 200 horse-power to the Pere Marquette Railway shops. The necessary equipment and material is to be purchased.

The Town Council of Petrolea, Ont., recently passed a by-law authorizing an issue of twenty-five year debentures to the amount of $15,000. This will be used by the Petrolea Hydro Commission for the building of line extensions to various factories and other power-users.

It is anticipated that Aylmer, Ont., will be supplied with Hydro current by August 1. A 13,200 transmission line is to be constructed from St. Thomas. For street lighting provision has been made for 250-watt lamps on standards spaced 125 apart in the main business section and 100-watt lamps in other sections. There will also be a lamp on every corner in the town.

C. E. A. Holds 'Business' Convention

Entertainment and Social Features Eliminated—Valuable Reports of Committees Presented and Discussed—The Electrical Industry of Vital Importance in War Work—President D. H. McDougall Unanimous Choice for Second Year

In accordance with the decision of the managing committee of the Canadian Electrical Association, the convention held at the Ritz-Carlton Hotel, Montreal, on June 7 and 8 was of a distinctly business character. The attendance was large, the reports and papers of a technical and practical character, dealing with various phases of the association's work, and the discussions complete and of great value in elucidating many points raised in the reports and papers. The only departure from the strictly business programme was an informal dinner tendered by the members of the Montreal companies section, who gave the visitors a more than cordial greeting.

The session opened with the address of Mr. D. H. McDougall, the president:

President McDougall's Address

This is the twenty-seventh annual convention of the Canadian Electrical Association.

The electrical or central station industry in Canada has passed through perhaps the most eventful year since the founding of the first company in 1884.

The conditions imposed on our companies by the war have required resource, courage, and ingenuity as never before.

The demands for current have in most cases been abnormal, due to munition manufacture, and from the fact that Canada herself is prosperous; and these conditions have been met by the companies, for the most part, in spite of the extraordinary difficulties of financing, in spite of the inroads on our staffs made through our best men enlisting, due to the voluntary system we have been following, and in spite of the great difficulties many of our member companies have experienced in securing an adequate supply of coal.

In regard to financing, our usual market for selling our securities—namely, the London market—has, of necessity, been closed to us.

For a time the United States markets were of great assistance, but later, when it became apparent that America was herself likely to answer freedom's call and take up with us the task of restoring peace to the world, which involves the suppression of the autocracy which seeks to dominate us, all these markets apparently become more difficult to secure aid from.

It has become evident to many of us that we must be prepared to temporarily forego any extensive financing, and must limit our capital requirements to items of a most imperative nature, and which can be financed among our own shareholders, or in the Canadian money markets.

Many Employees Answer the Call

The central station companies, through their employees, have demonstrated in no uncertain way their loyalty and love of freedom in the ready response made in answering the voluntary call for service in the wider field offered by the call to arms. From every quarter it will be found that the percentage of men enlisted from the central station employees is nearly double that of the percentage of enlistment from the general localities of the various companies.

Here in Montreal I am informed that about 35 per cent. of the normal number of men employed have enlisted, and in Toronto about the same ratio obtains, both from the private and the municipal company.

While this is what we would expect, as we are aware of the spirit of esprit de corps which has prevailed among our employees, especially when we remember that "service" is always our slogan, which we endeavor to preach to our men, still the demands made upon our service to our customers has caused our department heads many anxious thoughts, and I think I can safely say that from our experience we, one and all, will agree that if Canada had adopted selective conscription from the start, many of our highly-trained and dependable men would have been spared to help us share the responsibilities which the war has imposed on us, and that many of these men would have rendered at least as effective service to the cause had they remained at home: We congratulate our friends of the National Electric Light Association on the decision of the American authorities on the methods of recruiting adopted by their government. We feel sure it will spare them from many of the worries we have suffered.

The supply of coal has been another source of worry to some of our member companies who are dependent on steam generation, conditions due largely to car shortage, brought about, I am informed, through lack of ocean bottoms and consequent freight congestion at the gateways of ocean transport.

I have every reason to believe that we can look for no improvement during the coming winter, and would urge the companies who require coal to use every possible effort to provide themselves with a large reserve during the summer months if they can secure it.

Unfair Comparison

A large number of our members have been further embarassed by the wave of municipal ownership that is now prevailing in Canada. It has recently made its appearance in British Columbia and elsewhere, and the experience in some quarters of inadequate service, service such as no private company in Canada was ever guilty of, does not seem as yet to have been sufficient to cause our worthy municipal authorities to pause. The advocates of municipal ownership point to the large savings that have been effected in Ontario, and draw comparisons to prove their claim to the difference between rates now charged compared with rates charged in 1910, or seven years ago, when hydraulic power was in its infancy and rates were based on old and inefficient steam-generating units. They overlook the fact that in cities like Chicago, where modern methods have been used, an equal reduction has taken place without the necessity of pledging the municipal credit for a much inferior service.

Our membership, as will be shown by the secretary's report, shows the association to be in a flourishing condition, and our finances, I am pleased to say, are in better shape than they have been for some years.

In closing, I desire to inform you that a singular honor has been conferred on the association by the election of your president to the position of vice-president of the National Electric Light Association. This compliment was conferred on the Canadian association, and is to be taken as an evidence of our allies' desire to further the friendly feeling that has always existed between us.

Your committees have been energetic during the year, and have provided interesting and instructive reports, which I trust will provoke instructive discussion during our session. The thanks of the association are due to them, and also to the members of your executive committee, who have been active in your interests during the year.

After the reading of some correspondence Mr. Muldaur, the field secretary of the N.E.L.A., made a short speech, outlining his work during a recent trip in the United States and Canada. He told of the work of visiting the various cities, especially dwelling upon the importance of co-operation, and of the men getting together with a view to discussing their problems and thus proving of mutual help.

Mr. Maclachlan then presented the Accident Prevention Committee report. It was written, he said, in such a way as to provoke discussion:

Report of Accident Prevention Committee

By Mr. Wills Maclachlan, Chairman

Your Committee on Accident Prevention was appointed by the President on October 18th, 1916, and since that time has held meetings and has carried on a considerable amount of work by correspondence. The question of accident prevention has been considered by this Association for some years, as the Association no doubt realized that it was an extremely important phase of central station practice. In the United States a number of the chief executives of the various electrical companies are giving this work their very close consideration, and it is certainly reasonable to expect that men in similar positions in Canada should take a similar view. One of the difficulties that an employee of an electrical concern is laboring under is his inability to secure insurance at a reasonable rate, the insurance companies claiming that the electrical industry is an extremely hazardous one. It is certainly just that the Association representing the electrical industry should investigate ways and means whereby the industry can be made less hazardous so that our employees will not be confronted with such difficulties.

What Accidents Mean to a Company

The owner or chief executive of a power company should investigate what accidents mean to his company. At the time of an accident there is the danger of damage to expensive machinery, the upsetting of an organization that has taken years and a great deal of money to bring up to its present state of efficiency, there is the danger of injury to the public as well as the possibility of a shut-down, and these all in addition to the cost of the damages or compensation that have to be paid to the injured man. Your committee well realizes that in the smaller companies and in some of the large ones an accident is a very unusual occurrence, yet when it does happen it often costs a man his life and stigmatizes the electrical industry as a very dangerous occupation. Is it not worth while to spend a little of your time and money regularly to try to prevent these accidents instead of merely insuring your men and paying them or their dependents something in compensation? By this we do not mean to start up a quick, large, active campaign and let it die out in two or three months, but to keep everlastingly at it until success crowns your actions.

The company and employer may be enthusiastic for the prevention of accidents, but if the superintendent and foreman are not whole-heartedly interested in the work the whole effort to a large extent will be wasted. These men are the instructors of the rank and file of the electrical industry. They are the ones who come intimately day by day in touch with the work that is being carried on, and they, above all others, are able to make the work of accident prevention a success or a failure. Their opportunity for assisting in this work is very large and just as large is their responsibility. The foreman or superintendent who has an accident in his gang or department should be held strictly responsible for the accident. He knows how the work should be carried out and is in a position to see that the men under him are correctly instructed and are competent to carry out the work in a safe and efficient manner.

Workmen Must Help

The man on the job, however, has an extremely important part to play in accident prevention. The employer is interested from a purely financial or a sentimental or broadly economic viewpoint. The foreman or superintendent is interested because it puts him in bad odor with those in authority and also because of his feeling for the man that is injured. But the workman looks at it, or should look at it, from an entirely different viewpoint. If there is an accident he will have a lot of physical suffering and there is a likelihood of his receiving an injury that will maim him permanently. The dependents of most workmen are totally dependent upon his ability to bring in the monthly wage. Should he not be interested in anything that is going to insure his ability to be able to bring in that wage as long as he lives, and until his family are grown up to such an age when they are self-dependent? In analyzing accidents we are struck with the repetition of the reason given for the accident —"I forgot." Forgetting may be alright in some industries, but it is sheer suicide in the work of an electric power company. Real accident prevention can only be carried out by the hearty co-operation of the employer, the foreman and the workman; where you have these three working together toward the one aim of preventing accidents, you have very successful results in accident prevention.

Connection with N. E. L. A.

For the last two years the chairman of this committee has had the honor and pleasure of representing the Canadian Electrical Association on the Accident Prevention Committee of the N. E. L. A. This is the connecting link as far as accident prevention is concerned between the work of the Canadian Electrical Association and the N. E. L. A. It has been of considerable assistance in our work to have the opportunity of viewing the broader field of accident prevention as carried out in the member companies of the N. E. L. A. It has also been of considerable assistance in preventing any overlapping between the work of these associations. Those members of this Association who have had the honor of working on committees of the N. E. L. A. will readily see the great assistance that this connection has afforded and we wish here to publicly thank the chairman and members of the Accident Prevention Committee of the N. E. L. A. for their great assistance and co-operation during the past two years.

Your committee has carefully considered methods of organization for accident prevention and has come to the conclusion that the method as outlined in Appendix "D" of the report of the Accident Prevention Committee of the N. E. L. A. presented at Chicago in 1916 is the most practical and satisfactory method of carrying out this work. In brief, the method is as follows:

The president of the company should hold a meeting at which the chief executive officers are in attendance, and should explain to them the resolution of the company to actively engage in accident prevention work. This is one of the most important steps, because without the hearty co-operation of the heads of the departments any work in accident prevention will be extremely slow. A careful examination of the physical plant should then be made and all hazardous conditions rectified. It is useless to ask employees to assist in preventing accidents unless the employer can show in some physical way that he is in earnest in trying to carry out this work. A central committee to have charge of accident prevention should then be formed, this to consist of the heads of those departments employing the most of the workmen. If necessary an intermediate committee or committees should be formed in departments. Employees' organizations should then be formed to give an opportunity for the employees to discuss ways and means for the prevention of accidents. The recommendations of these employees' organizations are then forwarded to the accident prevention committees for action. As will be realized, this work will not run itself. When a piece of construction work or a sales campaign is undertaken, it is made the duty of some one individual, similarly the work of accident prevention should be made the duty of some official of the organization. This is the plan of organization in brief, and it would be to the interest and advantage of all members of this Association to carefully read and analyze the plan as given in full in the above mentioned report.

Various Safety Devices

From time to time various safety devices are presented to the Accident Prevention Committee of the N. E. L. A. These devices are such as have been successful in the work in the various companies. A station foreman in one company may work out a good way of protecting a certain standard piece of apparatus. Would it not be of assistance to the industry in general if this information was distributed? As a means of starting this work in the Canadian Electrical Association, a letter was sent to all member companies asking for their co-operation and help. We are extremely sorry to report that up to date we have received no replies.

Some of the matters brought before the N. E. L. A. Committee are as follows:

A lineman's insulating shoe arranged with a white rubber sole of good wearing material, inside of which is a red insulating piece of rubber, and when the white rubber wears through, the red rubber shows, giving an indication of danger. This shoe is found to be very adaptable to the work of lamp trimmers and would well warrant investigation by companies who are employing this type of man.

Goggles. A special form of goggle has been developed for use around electrical apparatus. This goggle is non-conducting and non-inflammable and fitted with the correct type of glass a great number of the injuries due to flashing of eyes by an electric arc would be eliminated.

Arc welder's helmet. The use of the electric arc in welding processes is becoming more and more general. A helmet has been designed formed of heavy fibre and open at the top. In the front of this helmet is inserted a round disc of the correct type of glass held in place by fibre washers and bolts. This helmet is found to be comfortable and gives the man ample protection.

Some other devices that have been presented are—insulating stools for station use, which will not tip over; danger sign caps for remote control switch buttons; fuse pullers with the handles made of red fibre, thus drawing attention to the place where the holder should be held; wooden nozzle for hose to be used around high tension apparatus; specially designed lamp trimmer's ladder, so arranged that it will not slip and can also be used as an insulating stool.

Suggestion for C. E. A. Members

This gives, in a short way, the type of some of the devices that are sent in by member companies of the N. E. L. A. We are certain that the C. E. A. member companies are just as live to the necessity of devising appliances for accident prevention, and we would suggest that in future blue prints and descriptions of these devices be sent in to the Accident Prevention Committee, so that this information can be distributed among the member companies.

Belts and Spurs

The practice in general in electrical companies is to require the linemen to supply their own belts and spurs. We recognize that there are serious difficulties in the way of arranging that the company supply these appliances, as well as the other tools, but as a safety measure it would be found of considerable assistance if the company could see its way clear to arrange for the supplying of all belts and spurs. Standard practice in regard to a lineman's belt points now to the use of the best harness leather, well sewed and riveted, the hardware of the belt should be either drop forging or bronzed, it being found that the D's of the belt become crystallized and break. Belts should be carefully inspected at least once every two weeks by someone other than the lineman using it. In connection with spurs—in the eastern part of Canada, the light spur or hook is most commonly used, but a dangerous feature in connection with these is the upper strap upon which most of the strain is thrown; these straps should be carefully inspected and when found in not first class condition should be discarded and renewed. The Western spur is used for the most part in Ontario and the Western Provinces; a dangerous point in connection with this appliance is the riveting of the sharp spur into the leg iron. Should this spur become loose, it should be immediately taken to a blacksmith and put in shape. Inspection and standardization of spurs and belts will go a long way in preventing line accidents. Most fatal accidents in line work are caused by the fall and not by electrocution, and this is principally due to the infernal habit of linemen refusing to use their safety belts.

Rubber Gloves

In the fall of 1915, the seriousness of the question of rubber gloves was brought to the attention of the Accident Prevention Committee of the N. E. L. A. Rubber gloves were being purchased by electrical companies, and in the majority of cases received absolutely no "acceptance" test; there was no such thing as a standard rubber glove, and the whole question was found to be in a very deplorable condition. If an electrical company was guarding a priceless piece of machinery that could not be replaced, is it not reasonable to expect that the guards used would receive most careful inspection and be put through a most rigid test. Linemen and operators are required to work on 2200 volt lines that are alive, and the only reason that they are able to do this work is because they wear rubber gloves and use the other necessary precautions. Having this in mind, should not the company and the employees be very inquisitive as to whether the rubber gloves are safe for the work in hand?

During the year 1915-16, a preliminary series of tests on rubber gloves were carried out and a progress report made to the Chicago Convention. During the year 1916-17 a more elaborate series of tests were carried out, and it is found that more time is necessary before a definite report can be made. Some points, however, can be deducted from the work so far carried on. The standard rubber glove will be for work on lines the voltage of which to ground is not more than 3,000 volts. The gloves are to be made by the dipping process, and are to be vulcanized by some other method than the acid method. The gloves should be marked in such a way that they can be easily identified. They should be tested for acceptance by electrical and physical tests; the electrical test to include a voltage test and the finding of the leakage current. It might be of interest to know that the results of a test which has been put to a number of people holding a pair of pliers in one hand and having the other hand immersed in a can of water resulted in the person being able to stand 6.3 milli-amperes at 18 volts, 60 cycle current and 6.8 milli-amperes at 23.5 volts. This is the result of a very carefully conducted test and the figures are certainly astounding. Another point that has come out in examining the question of rubber gloves is the matter of the storage of the gloves; they should be kept in a temperature of 60 to 75 degs. F. in a dark place, preferably each pair of gloves in a box by itself. The question of routine testing should be carefully considered. It is not enough that the gloves be inspected when they are first purchased, but they should be tested and inspected regularly. If you have an important meter on your line do you inspect it when it is purchased, put it in position and forget about it? I think you will agree with me that it is very carefully checked from time to time. The records of each glove should be kept on a card, this card to show the date of purchase, firm from whom purchased, price, date of acceptance test, record of test and record of each routine test, with date.

Resuscitation

In the British Medical Journal, March 8th, 1913, you will find the following:—

> "The importance of getting to work with artificial respiration without a moment's delay has often been emphasized by those who have had much experience in electrical accidents."

In the Report of the Accident Prevention Committee of the N. E. L. A., 1916, you will find:

> "That in all case of unconsciousness from electric shock, the Prone Pressure Method shall immediately be applied by persons instructed therein and that mechanical devices for artificial respiration shall be used only as auxiliaries and then only by trained laymen or physicians."

Here we have the highest authority in the medical profession in England and the United States, together with a report of the N. E. L. A., impressing the necessity of immediate action in the case of electric shock and resuscitation by the prone pressure method. Anyone who is interested in the subject can collect a considerable amount of evidence as to successful cases of resuscitation, and we feel sure that they will come to the one conclusion that is stated in the report of the N. E. L. A. Committee.

If resuscitation by the prone pressure method is to be used, then, careful training of all employees in this method must be entered into, and constant practice therein maintained. We agree that it would be far easier and possibly cheaper to buy a piece of apparatus, install it at some convenient point and depend upon it to resuscitate men when they receive a shock, but we are forced to the conclusion after analysing numerous cases of attempted and successful resuscitation from electric shock, that the only safe way of protecting employees from electrocution is by a well-trained force in the Prone Pressure Method of Schaefer.

Success by Prone Pressure Method

It is not the intention of the Committee to take up your time by citing cases of successful resuscitation, but the following is a fairly typical case. A man in a construction gang was left behind to finish some work outside a sub-station. He was warned not to do this work while the power was on. However, to save time he attempted to do the work and received a shock of 33,000 volts and dropped to the ground. The sub-station operator heard the flash and ran out and called for help. He immediately went to work on the man and started resuscitation. Two doctors came along and told him to stop work as he would certainly kill the injured man; he refused to do this, and the doctors forcibly pulled him off his patient. He ordered them off the company's property and told them he was in charge of the case and went back at his resuscitation. Shortly after, two other doctors came along, one of which was the company's doctor. He immediately started in to help the operator, who, by this time, had the man partially breathing. The man was soon breathing and was removed to the hospital. Since that time he has fully recovered and is back on the job.

Educate the Medicals

That is the result of well trained employees in resuscitation. Far better results could be obtained if co-operation between the medical profession and the electrical profession could be instituted, each we feel has a great deal to learn from the other, and with this end in view your committee has pleasure in moving—"That the executive committee of the Canadian Electrical Association is hereby instructed to get in touch with the officials of the medical profession in Canada and other interested electrical bodies and that a Commission be appointed representing these various bodies, and that it be instructed to investigate the mechanical and manual methods of resuscitation from electric shock and report as to what they consider to be the best method to use in the work of an electrical company."

Ground Chains and Clamps

Your committee would like to hear discussed the relative merits of the protection of linemen by ground chains or by ground clamps. In Ontario recently, two men were killed on a 6600 volt line while they were working between a chain, shorting the line but not grounding it and a sub-station. The switch in the sub-station was thrown in, one man receiving a shock and falling about 35 feet, the other man receiving a bad shock and burn, but not falling. It has been standard practice to use ground chains, but some of the companies are now discarding these and using grounding clamps. The subject is an important one and we feel that much good could come from a discussion.

In closing, your committee feels that it has done very little during the past year, matters having to do with assistance of technical men in carrying on the war making it impossible for the chairman of the committee to devote very much time to the work. We feel, however, that the work of accident prevention should receive from year to year the careful consideration of this Association and hope that a committee will be appointed to carry the work on during the season of 1917-18.

Respectfully submitted,

W. T. Burgess, Montreal, Que.
Chas. H. Hutton, Hamilton, Ont.
Geo. Kidd, Vancouver, B.C.
J. T. Lambert, Ottawa, Ont.
E. L. Milliken, Sydney, N.S.
J. F. Neild, Toronto, Ont.
Wills Maclachlan, Chairman, Toronto.

Discussion

An animated discussion resulted. Mr. P. T. Davies referred to the use of rubber gloves and to medical inspection, instancing the good work which was being done in the latter direction by the Canadian Consolidated Rubber Company, who retained a medical officer for this work. Mr. Davies also touched on the prone pressure method of resuscitation, and emphasized the need of employees being made familiar with such methods.

Mr. Milliken pointed out that it was important to see that proper precautions,were taken to avoid accidents when moving from old to new central stations.

Mr. Williams thought foremen should be held accountable in cases of accidents to men under their charge.

Mr. Dion was a strong advocate of the prone pressure method, as it had been found of great benefit.

Messrs. Winter, Doddridge, and Maclachlan also spoke in favor of this system.

Col. Street stated that the low rates of insurance had been obtained largely through the efforts of Mr. Maclachlan.

The president remarked that the Ontario Act had been amended in favor of the workmen, owing to pressure by the labor unions. If this was continued it might result in a a demand that the men be physically examined, and it also might ultimately result in a further demand that single men only be employed by the employers, owing to the severe penalties provided for married men with large families.

Lighting Sales Bureau of N. E. L. A.

By Mr. E. N. Hyde

The establishment of committees under the leadership of their respective leaders (tabulated in Mr. Hyde's report), formed the groundwork to be covered in the real work of the bureau and in the concrete aim to secure constructive data available to members relating to the following phases of central station lighting activities:

Increase business in houses already wired by introducing outlets for irons, toasters, etc. (in themselves current consuming devices), and ornamental stand lamps.

To show methods by which greater sales of current can be effected by lighting of bulletin boards, wall signs, roof signs, strip and outline lighting, window and interior signs.

Store lighting permits of better shop windows, rug frames, special color matching booths (daylight lamps), and efforts to increase foot candle intensities.

Public buildings, such as churches, theatres, armories, schoolhouses, hospitals, libraries, federal and municipal buildings, office buildings, railroad and steamboat stations, halls of apartment houses hotels, bulbs—all offer opportunities for better lighting, with the consequent increase in current consumption.

Street and Highway Lighting

The subject of street and highway lighting seems to embody problems which are neither technical nor of importance because of the current consumed. While, of course, current consumption is not overlooked as a means to an end, yet the aim seems more in the direction of securing commensurate prices for street lamps where now installed, the prices obtaining being in the aggregate far lower than they should be. Obstacles encountered by the adverse attitude taken by the public in general, fostered by local newspapers and frequently championed by political axe-grinders, such as aldermen, councilmen, and in some instances by mayors or county commissioners, have made the work of educating the fair-minded in many communities extremely difficult, and the efforts of the Street and Highway Committee to secure useful data that are convincing and yet fair by which the returns on street lamps in dollars and cents per lamps year from each community, and with variation in the rates commensurate with the difference in local conditions, both as they relate to the geography of the lighted areas and production costs of the current to the central stations, deserve special support and encouragement, not to say mention in this report of the Lighting Sales Bureau activities.

In the 1916 reports some data are given showing increase in production and decrease in spoilage of materials manufactured in industrial plants. These data are to be further increased with other concrete examples, besides which examples of the better facility with which the incoming raw materials and outgoing finished products can be handled outside factories, in yards and railroad sidings, will be given in the Industrial Lighting Committee's report.

Outdoor Lighting Data

The Outdoor Lighting Committee will present unique data more in line with new applications than probably any of the other sub-committees. The advent of the gas-filled incandescent lamp and its exceptional value in connection with projectors or so-called flood-lights gives this committee a newer subject with which to deal, but the unlimited expense and enthusiasm and care with which they have secured data and co-related them deserves special mention and commendation. The lighting of recreation grounds, pageants, monuments, carnivals, military camps, bathing beaches, areas being excavated, strippings, and the like, will be given attention and photographs secured, besides which the whole mass of details will be carefully edited and prepared for reference.

Since the Nela Park meeting two more have been held—one at New York City, on November 24, 1916, and again at Pittsburg, February 16, this year. These meetings devoted the time to reports on progress made and the interchange of suggestions to stimulate further investigation into subjects under consideration. Also at these meetings steps to avoid duplication of effort have been taken and motions adopted which had for their aim more complete co-operation with the parent organization in its program for the year and the presentation of reports and findings at the May annual convention.

The bureau has also followed precedent by suggesting to the Executive Council the names of successors of the present officers and sub-committee chairmen of the Lighting Sales Bureau, who can carry on the work throughout the fiscal year ending May or throughout 1918. ,

Respectfully submitted,
E. N. Hyde,
Canadian Representative Lighting Sales Bureau.

Discussion

In presenting this report, Mr. E. N. Hyde elaborated the various points dealt with. He said that the document presented that day was not the actual report, but represented the meat of the efforts of the various sub-committees. There were two questions, from the business-getting point, with which central stations were confronted. There has been a diversity of opinion in the States as to whether the larger central stations should invest in extensions, owing to the heavy cost of building, and as to whether such extensions would be profitable. If not, the extensions would have to wait until times were more normal. This also applied to the apparatus required. Another question was as to smoothing out the load curves and the obtaining of business which would fill up the valleys of the load, bringing them up to the peak. The subject of residence lighting had been somewhat neglected in the past, because the revenue was not so attractive as that from the stores. Here were opportunities to give an off-peak load. He also felt convinced there were a number of small outlets which would add to the revenue for residences. The electric advertising sign business had not been very satisfactory to central stations, owing to the lack of lamps. The central stations were justified in making every effort to see that there was a full equipment of lamps, and that the signs were efficient in the matter of giving advertising service.

With regard to store lighting, there had been considerable attention given to making electric light equal to daylight, so that service could be given to customers in the matter of color-matching, etc., and at the same time prove economical to the stores. Touching on the lighting of public buildings, Mr. Hyde referred to experiments made in the United States with a view to determining the best methods of letting the light fall on objects in museums, etc. The results of these experiments were to be incorporated in the new Boston Arts Building. After a reference to industrial lighting and wiring, it was pointed out that larger size lighting units in industrial plants were more economical. Mr. Hyde remarked that outdoor lighting was full of opportunities for the central stations.

Mr. Hyde also dealt with the commercial aspect of street lighting. There were, he said, a number of communities where the competition between companies was very active, and the result was that the company who obtained a street lighting contract felt that it should have preference. The consequence was that many contracts had been for long terms, which did not give any appreciable profits. There was also the question of terms given in towns which adjoined, regardless of the peculiar conditions governing the questions of supply.

At the afternoon session Mr. H. E. Howe, of Arthur D. Little, Ltd., spoke on electro-chemical products.

Developments in Electro-Chemical Industry

By Mr. H. E. Howe

One need not apologize for introducing the subject of chemistry in any gathering at the present time, for the present extraordinary conditions have made all understand more fully its relation to all phases of everyday life.

Electricity and chemistry are mutually helpful and mutually necessary. Many of the most important chemical achievements of our time would have been impossible without electricity, and industries which have become a necessity could not be maintained without its assistance. On the other hand, the perfection which has been attained in electrical apparatus and the present possibilities in the field of electrical science would have been impossible without chemistry. For example, the application of electricity depends, one might say, primarily upon almost chemically pure metals, especially copper, in the production of which a chemist figures very largely. Insulation problems are also in the field of the chemist, and the incandescent lamp has relied upon chemistry and physics for its present high state of efficiency.

Electricity is of especial use in chemistry, because it is a form of energy which can be controlled; it is reasonably constant and dependable; it is very concentrated, and is without many of the disadvantages of other forms of energy, such as products of combustion. Its only disadvantage is its relatively high cost.

Electro-Plating

Electricity was first applied to chemistry for electroplating one metal upon a base metal for decorative or preservation purposes, or as a means of deception. In electroplating the passage of direct current causes the metallic ions to take a desired direction and become deposited upon the metal suspended, as the cathode, while the chemical nature of the bath and the electric current cause the anode to dissolve at a rate to approximately maintain the metallic strength of the bath.

Electricity was next applied to processes for refining metal, and this is the natural outgrowth of experiments in electro-plating. Copper is of the greatest interest to the electrician in this connection. The Bessemerized matte contains many impurities which are partially removed by furnace refining. The copper is then cast into anodes, which are suspended in a solution of copper sulphate and sulphuric acid. Some of the impurities are precipitated to the bottom of the tank and slowly dissolved. Others are transformed into insoluble salts; several dissolve, but do not plate under the conditions present, and the result is a copper deposited at the anode almost absolutely free from impurities. Of late years lead, zinc, and copper have been successfully separated electrolytically, and other metals, such as gold and silver, refined by a modification of the copper-refining process.

About twenty years ago our present electro-chemical development began. Some of the processes are electrolytic, others electrothermic, and still others combine both. The production of aluminum was the first process to be worked out; bauxite is added to a fused bath of aluminum-sodium-calcium fluoride, in which it is decomposed, and the metallic aluminum drawn off. Twenty-five thousand kilowatt hours are required per ton of product. It is one of the cases where the high power consumption enables the raw material to be brought to the power, and the product is such as to withstand the charges for transportation over great distances.

Abrasive Production

Abrasives were next, and this has become a very important industry, especially now that most of the natural abrasives are off the market. Previous to the war about 75 per cent. of the abrasives used in North America were made in the electric furnace, while at present practically 100 per cent. is supplied from this electro-chemical process. Graphite, with the production of 800,000 pounds in 1900 and 40,000,000 pounds in 1916, was first found in a carborundum furnace which had been overheated. This has become one of the mainstays of the electro-chemical industry, since natural graphite is not sufficiently homogeneous to permit anodes for carbide and other furnaces to be successfully made from it. It has also entered largely into the fields of lubrication and dry batteries, arc lamps, and wherever uniform carbon of a given grade is required.

Next in the list is phosphorous, followed by carbide, alkali, and chlorine, the ferro alloys, organic compounds, and the fixation of atmospheric nitrogen. It is difficult to say which is the most important, for they each have their special fields of application, and all fit into their various places in our complex civilization.

One is immediately confronted with the question, Why are not all of these industries located adjacent to water-powers; and the answer is purely an economic one. In some places electricity can be generated, using coal at a price to compete with the best water-power figures available at the present time. In other instances it is a matter of the market for the finished products, some of which are unable to stand high transportation costs. If electricity is to be used in increasing quantities in the chemical field, electricians must help us to find a way of obtaining this energy at a lower price.

The Commercial Light and Power Committee Report, presented by Mr. Gilman, followed.

Report on Commercial Light and Power

By Mr. M. C. Gilman, Chairman

In presenting our report herewith your committee has endeavored to mention briefly a few only of the more important subjects of present-day interest to our commercial members. In order to cover the field as thoroughly as is practicable in so limited a paper, we have confined our scope to the four following subdivisions:

Lighting and motor power sales.
Electric ranges.
Electric vehicles.
Other uses of electricity.

LIGHTING AND MOTOR POWER SALES

Residence and Store Lighting

By far the great majority of our member companies primarily were distributors of lighting service only—many, in fact, did not operate their stations during daylight hours. The coming of the alternating current motor, with the consequent rapid increase of motor power sales, has changed all this.

To-day, with nearly all of us, the ratio of the lighting output to the total kilowatt-hour sales is steadily decreasing. Fortunately, however, due to the lighting rates being higher than the power rates, the decrease in the ratio of lighting income to total revenue is not so rapid. Our light-customers show a steady, natural growth in number. The income from these customers, due, first, to rate reductions (possibly ill-advised in many cases when viewed in the light of to-day's operating expenses), and, second, to the marked increase in lamp efficiencies, does not show a proportionate growth.

The advent of the half-watt lamp now coming quite generally into use, in sizes as low as 60 watts, is in itself serious, and must lead us to expect considerable further improvement with a cumulative effect of lowered lighting income.

In the past we have seen that it has paid well to employ competent power engineers to assist our motor customers in receiving the service we have been prepared to render. Aggressive policies toward obtaining all available power business have so increased the power output that, with most of us, it now forms by far the greater percentage of the total output, and a constantly increasing proportion of the total revenue.

Rather than to tamely watch our lighting business take a back seat we should pattern after our power experience, and apply correspondingly aggressive tactics. We need competent salesmen to handle our lighting problems precisely he same as power engineers are required to solve power problems.

At a time when all service and line materials are daily soaring to new heights we should practice intensive rather than extensive methods of income increase. Lighting service is not expensive. To the average consumer, either residence or commercial, the cost of his lighting is hardly noticed when considered with the other operating expenses. As an offset to the increasing lamp efficiencies let us secure even larger increases in our existing customers' lighting consumption. This may be done by means of systematic effort on the part of our experts on illumination to encourage:

1. The use of higher intensities of light.
2. The adoption of indirect and semi-indirect system of illumination.
3. The use of light of controlled color.

It is generally known that even the brightest interior by artificial light employs only from one-tenth to one-fifth the intensity of daylight. Let us make more general use of the gas-filled lamp, but in doing so properly conceal the source of the light, so as to avoid all glare. By so doing an intensity of double that of the average present artificial light can be attained, with better economic results, both to our customer and to ourselves.

We should co-operate with our glassware manufacturers to see that our semi-indirect units are constructed of sufficiently dense material to effectually do away with all glare. Some of the glassware now in use is almost as bad as the bare lamp. Possibly our oculists will notice a decrease in the number of their patients suffering from eye-strain, and certainly our lighting incomes will be increased.

The blue glass "daylight" lamp is coming into favor rapidly with department stores, for purposes of color matching, etc. It is very doubtful if the store managers feel that the increased consumption of electricity required to give even moderate light intensity is not worth while. The proper color at the light source—for instance, the use of amber bulbs with dense semi-indirect glassware—will require considerably more current, and the bills will be higher, but the results to the customer will be such as to more than warrant his increased expenditure.

Industrial and Flood Lighting

It is felt that now is an opportune time to devote more of our energy to the bettering of the lighting in our factories. War orders are causing a large number of these factories to operate throughout the twenty-four hours, and ample lighting is not only desirable but absolutely essential if spoilage is to be reduced and accidents avoided.

Brilliancy should not be mistaken for illumination. It is practically necessary always to combine proper general illumination by means of large units correctly spaced, with localized lighting over equipment requiring a higher intensity of light.

Protective lighting for industrial plants and other places of strategic importance is receiving considerable attention, and should be encouraged, if for no other reason than because the proper use of artificial light during times of war will release large number of guards for more effective use in other fields Gas-filled lamps of 400 or 500 watts, with suitable reflector equipment, are generally employed for this work.

A very interesting example of the value of flood lighting is afforded in the asbestos mines at Thetford, Que. By installing flood lighting for their pits and thus operating twenty-four hours daily, the management have been able to largely increase their output without increase in equipment, and, incidentally, the central station supplying the electrical energy has been able to supply about half again as much energy to the motor equipment of the mines, due to an increase in load factor from 45 per cent. to 65 per cent.

Motor Power Sales

Perhaps never in the history of the world has the central station proved itself of such immense value as since the outbreak of the war. Nearly all of our munition output is dependent upon central station energy. Manufacturers have been enabled to speedily double and triple their plants, and have always found a reliable and adequate power supply at their door.

On account of such general increases in the demand for power a number of our member companies are now finding it extremely difficult to continue to take on power business. We urge that special consideration be given to the important matter of adequate protection against low power factor operation on the part of customers. Suitable clauses in power contracts should be inserted to enable the company to receive rightful compensation for existing low power factor. The enforcing of such clauses will be found of the greatest aid in influencing customers to alter existing methods to conditions more suitable to the power supply authorities. Certain water power plants are unable to take more water, and have been forced to install added steam capacity. The difficulty in receiving the requisite coal for the steam operation renders the operating superintendent's position anything but pleasant.

Some of our companies are giving considerable attention to the sale of "interrupted power," and are making contracts whereby the purchased energy may be cut off during peak hours. The sale of this "off-peak energy" has not been confined to users of large blocks of power, such as electric furnace plants, etc., but has been extended to include hotels, office buildings, and factories where isolated plants are being operated during peak hours. By thus taking advantage of local conditions the central station is enabled to continue to increase its power revenue, without adding to its peak load.

ELECTRIC RANGES

This subject naturally presents itself to your committee from the viewpoint of the central station, and for the present, having regard to our purposes, the matter will be considered chiefly from that angle.

The demand made upon central stations in industrial centres in Canada to operate munition plants and allied industries has, in many cases, called for their entire reserve capacities to meet the requirements, and in consequence, the development of the range load has suffered. There is, however, a very general interest on the part of the public on the subject of electric cooking, and more particularly in the natural gas belt in Western Ontario, where the gas distributing companies have failed to properly take care of the business.

As to the future of the electric range business. the consensus of opinion among central station men throughout Canada and the United States is that it is now on a sound basis, and that its adoption will be universal within a very few years. There is considerable diversity shown in reports as to the revenue which may be expected from this source, due to widely varying rates and forms of contract, but it may be stated without hesitation that the average revenue from range customers is approximately twice the lighting bill.

The character of the load is of vital importance to central stations. The range load will undoubtedly come on the daily peak of the average central station to a certain extent, but the development of ordinary lighting business will increase the peak in any event, without filling up the valleys in the way a range load does. Ranges utilize a considerable amount of energy between 11.30 a.m. and 1 p.m., at a time when power business makes its smallest demand during daylight hours. It has been stated when the electric range comes into general use among all classes of customers that the station peak will occur between these hours.

The maximum demand of the individual range averages about 50 per cent. of the connected load, while the maximum demand of a group of twenty ranges, or more, rarely exceeds 15 per cent. of the total capacity. It will be seen while the maximum demand of an individual customer may seem high, and in consequence of this consdierable additional investment may be necessary to take care of the isolated customer, that the business lends itself most acceptably to intensive cultivation. The result of this, in view of the very wide diversity consequent upon the fact that cooking conditions in no two homes are exactly alike, is a very low demand in proportion to the connected load. To put it briefly, the more ranges connected the lower the demand factor will be. To illustrate this point, the maximum demand on a single range is approximately 50 per cent. of the connected load; on three ranges it is approximately 33 per cent. of the connected load; on twenty ranges it is approximately 15 per cent. of the connected load.

Water Heating

A class of business very closely allied to electric cooking is that of water heating. One can scarcely be considered without the other, for very often the installation of an electric range means the removal of the old method of heating water for domestic purposes. While the load characteristics appear to oppose each other they have a complementary effect in balancing the load curve. The peak of hot water heating often comes on as late as 10 p.m., where heaters are used to a large extent for dish washing and bathing. The report of the Electric Range Committee for the 1916 convention of the N.E.L.A. goes very exhaustively into this subject, and consequently the present article will not deal with the matter in detail.

One of the principal member companies in Canada is engaged at the present time in working out a plan to sell, on a term basis electric ranges connected up ready to operate. The same company already has in effect a water heating proposition, nuder which they furnish, install, and connect water heaters for a definite sum. These heaters are arranged to be connected for 500 watts under a flat rate, and 2,000 watts through the meter. Current for the high heat is sold at the residence rate, the heater consumption usually being billed entirely on the third step of the rate, which is low.

It is recommended that so far as possible water heaters installed in connection with ranges be placed on a double-throw switch, so that the water heater is not in circuit while the range is in use.

Development of the Business

The following brief statements are the views of representative central station men in touch with the demands of the situation:

"Central stations must plan to take care of as much business as gas companies have in ranges."

"Efficient salesmen specializing in the business of ranges must be employed."

"Educate the customer in efficient operation."

"A national publicity campaign on the ease, safety, cheapness, and other advantages which the electric range alone possesses."

"Central stations must sell service rather than kilowatt-hours and cooking rather than ranges."

"The fullest co-operation must obtain between the manufacturers, contractors, and central stations."

It is clear that we must begin at once to take electric cooking and auxiliary heating seriously, and exercise the greatest care in its development, as this will result in very greatly increased output. Every commercial manager will have his own problems to work out. Some of the difficulties in the past have been:

(a) Unfamiliarity on the part of the housewife with electric cooking. This has been dealt with in the foregoing statements.

(b) The cost of energy to the consumer. No definite figures can be given as to the price per kilowatt-hour which should be charged for service. This will depend upon local conditions, the cost of supplying power, as well as the cost of ranges or connection, we may look for marked reductions in prices as time goes on.

The cost of connecting ranges at the present prices for labor and material is high, and a careful study should be made with a view to lowering this cost and at the same time keeping in mind the requirements of safety.

The high efficiency of the electric range and its manifest benefits, however, make it very attractive, even under present-day conditions.

(d) The cost of distribution. Many companies are not prepared, so far as their circuits are concerned, to take on cooking load without some considerable additional expense. It has been established that the cost for individual service range from $75 to $100. As the business grows, however, the cost per customer will decrease considerably. In fact, three customers can be connected for twice the cost of one. When the revenue to be obtained from this expenditure is taken into account and the fact that the load has a power factor of 100 per cent., it will compare most favorably with power business.

Good regulation is very important in supplying a satisfactory range service. The question of keeping down the cost of distribution and at the same time providing satisfactory regulation is a most important one, and one that your committee recommends the association to carefully investigat

It seems best that stove services should be put in on the three-wire, 110/220-volt system, and that ample transformer capacity be provdied, either by banking existing transformers or the installation of larger units.

It should be noted, however, that in Canada the stove load overlaps the lighting peak for a short period only, and only in the cold winter months, when the transformers can safely carry considerable overloads for the short period of overlap.

Construction of Ranges

The consumer is now no longer limited to a selection of two or three makes of range, There are a considerable number of manufacturers furnishing a satisfactory product, but it seems desirable, as yet, that ranges should be sold through the central station. The principal feature is necessarily the burner. The two standard types are the open coil burner, producing heat by radiation, and the coil burner, operating on the principle of conduction.

Manufacturers are guaranteeing a life of from 4,500 to 5,000 hours for their burners, and they can be readily renewed at a very reasonable cost.

The following features are now regarded as essential to a good range:

Some device to indicate whether the current is on or off.

Standard elements easily, quickly and cheaply replaceable and interchangeable as to size.

The construction of the oven and its burners should permit of the oven being thoroughly and easily cleaned. The lining should be so made that it is impossible for cooking vapors to get into the heat insulating materials.

A reliable thermometer.

Terminal contacts so placed as to give the minimum of trouble.

Separate fuses provided for the various burners.

Rigid construction of the stove frame.

Warming oven should fulfil its function.

The following are a few of the advantages to the consumer in the use of the electric range:

1. Kitchen cleanliness—no soot, dirt, or grease.
2. Bright, clean and attractive appearance.
3. Economy and efficiency—no great loss in shrinkage of food.
4. Safety—no flame or explosions.
5. Personal comfort.
6. Saving in space—of particular advantage in apartment houses.
7. Sanitary—no poisonous gases; oven can be kept thoroughly clean.
8. Regulation, perfect control.
9. Even temperature.
10. Coolness, no waste of heat.
11. Certainty in results.
12. Perfection in baking or broiling.
13. Appetizing food, digestible and nutritious.
14. Progressive—last word in development of household cooking.

Attention is directed to the following publications on this subject:

The report of the Electric Range Committee, presented at the eighth annual convention of the Northwest Electric Light and Power Association, Portland, Ore., September, 1915.

The report of the Electric Range Committee, thirty-ninth annual convention of the N.E.L.A., Chicago, Ill., May 22, 1916.

Brighter and Happier Hours in Your Kitchen. Published by the Society for Electrical Development. New York City.

Care and Operation of an Electric Range. Hughes Electric Heating Company, Chicago, Ill.

Also the report of the 1917 Electric Range Committee, N.E.L.A.

ELECTRIC VEHICLES

In the previous sections of our report we have dealt with lighting and motor power problems, as well as the value of an electric range load. Transportation affords another wide use for electric service. Electric vehicles, both passenger and commercial types, are not new developments. Due to great improvements in the vehicles themselves and in the batteries, motors, and control apparatus, as well as to the high cost of oil and gasoline and to the constantly decreasing cost of electrical energy to charge the batteries, the use of electric trucks is growing rapdily.

The passenger car, or as it is frequently called, the pleasure car, is no longer a costly toy. It is steadily showing itself a strong competitor to the gas car in all respects, not only in city traffic but on country roads. Various authentic reports show runs of from 80 to 100 miles on a single charge of batteries, over hilly and none too smooth roads, and at average speds of from 18 to 23 miles per hour. This type of car, while admittedly good for suburban or country travel, is ideal for city use, being quiet, easily controlled, always ready, and extremely cheap to operate.

The "electric," however, is at its best when used commercially. As now manufactured, the electric truck is used extensively in practically all lines of business, predominating in express companies, department stores, breweries, bakeries, dairies, laundries, undertakers, fire departments, street cleaning departments, general trucking.

It is stated that the total value of electric trucks in the United States is approximately $36,000,000. If the same ratio in proportion to the population were obtained, Canada should possess electric trucks to the value of about $3,000,000. Information at hand shows that the total investment in electric trucks in the Dominion of Canada very likely does not exceed $300,000. From the above we can conclude that the field in Canada for the sale of electric trucks is very fertile and offers great possibilities either to the manufacturer or central station that is willing to put forth the proper amount of effort.

The principal reasons for the rapid success of the electric truck are the low upkeep and reliability. Supplementary reasons are the improvements in charging apparatus, the development of charging stations equipped with proper facilities, together with the increased capacity of storage batteries. In this connection it is interesting to note that the storage battery, as manufactured at present, possesses an average life of double that of a few years ago. The modern electric truck in city and suburban service is capable of going from 40 to 50 miles on one battery charge, a total travel per day that well satisfies the requirements of most commercial transportation. By using a spare battery this mileage may be easily doubled.

Large manufacturers and others requiring extensive trucking or large department stores have proved the immense value of the electric truck. Department stores in larger cities have come to depend nearly exclusively upon their electric delivery system, utilizing electric cars from 1,000 to 2,000 pounds capacity for their house-to-house delivery.

Electric Trucks in Baggage Handling

Due to the greatly congested condition of large shipping points, railroad terminals, etc., the use of trucks and tractors to pull trailers is rapidly becoming more extensive. The field for the use of these tractors is open to every central station located in a city which is an industrial or shipping centre. Nearly all factories can be profitably equipped with electric transveyors, and these do away with the handling of freight by hand trucks. The larger railroad systems are rapidly replacing the old type of hand-drawn mail and baggage trucks with the modern storage battery truck, which winds its way in and out of traffic, starting and stopping instantly, and at the same time carrying more than double the load formerly possible. In these days of large profits, manufacturers are oftentimes not keen to make investments where economy of operation is the only inducement. The modern by-word is "speed." In order to convince the factory manager that he should use electric trucks and tractors it is necessary, in many instances, to prove to him that their use will expedite his work. Expediency, more than economy, is becoming the governing factor.

From the central station point of view a battery charging load is becoming more and more desirable. The large demands for power made upon the central stations by war orders, etc., are increasing the demand for power made upon the system, without appreciably increasing the system load factor. Battery charging is naturally an off-peak operation—the trucks and pleasure cars, as a rule, are in operation during the day and are charged during the night. Central stations should foster the use of electric trucks in every way possible. Your committee believes that no better way can be found than for each member company to purchase electric trucks for their lamp and meter deliveries, as well as for carrying service materials to the job. By so doing the average central station not only can reduce its own delivery expense, but also will serve to show other prospective users that electric trucks are better in all respects than gas cars or horses for local deliveries.

In this connection it is interesting to note that one of our member companies report they are using six electric trucks, of various capacities, and by so doing have greatly decreased their garage expense. The same company reports that there are 160 pleasure vehicles in their territory and also about 40 commercial vehicles. The income from the sale of energy to charge these batteries approximates $15,000 per year.

OTHER USES OF ELECTRICITY

The preceding divisions of this report have covered the more usual and more general uses of electricity, but there are, however, a large number of important uses which should be discussed, and therefore they are combined under this title.

Only those uses of electricity which directly or indirectly mean a substantial increased output for the central station have been included, and thus a large number of uses of electricity, although important to the consumers, are eliminated, since they do not require any considerable amount of energy.

Even with this restriction there are so many uses of electricity not otherwise covered that it seemed desirable to classify the various uses and processes brought to the attention of your committee under several sub-headings, which designate the character of the use to which electricity is put in the various processes shown under each sub-heading.

In order to indicate the relative importance of the various processes to the electrical industry it also seemed desirable that some indication be given when possible as to the amounts of power involved in each and the energy consumption per unit of product, and this data has, therefore, been included. The tabulation is necessarily rather inaccurate, and the data shown is only inserted for comparative purposes to indicate the relations between the various processes and the electrical industry.

Arc Heating Processes

Product.	Energy consumption in kw. hrs.	H.P. in use in Canada 1916-1917.
Calcium carbide	1.2 to 1.6 per lb.	75,000
Ferro silicon	3 " 5 "	80,000
Ferro manganese	2.5 " 4 "	1,000
Ferro titanium	2.4 " 5 "	1,000
Ferro nickel	5 " 7 "	1,000
Ferro molybdenum	3 " 6 "	500
Ordinary steel	0.3 " 0.6 "	40,000
Tool steels	0.5 " 0.8 "	3,000
Tungsten	3 " 5 "	.....
Zinc	0.7 " 1.2 "	500
Nitrogen fixation,	7.5 kw. hrs. per lb. of nitrogen	30,000
(Cyanamid process),	2.0 kw. hrs. per lb. of cyanamid	.....

Resistance Heating Processes

Calcining coal (carbon electrodes	2.5 to 4 per lb.	4,000
Graphite	1.5 "	3,000
Carborundum	3.85 "	2,000
Bauxite melting (chrystolon, alundum, etc.)	1.0 "	15,000
Spot welders		1,000

Electrolytic Processes

Zinc	300
Copper	.....
Hydrogen	1,500
Chlorine	1,500

Combined Electro Thermic and Electrolytic Processes

Caustic		.....
Aluminum	10 to 20 per lb.	40,000
Magnesium	20 " 40 "	2,000

Commercial

Monotype machines, 1 kw. per machine	.....
Chemical apparatus, various	2,000

Heating

Special applications, bake oven, industrial baking and drying; electric furnace; wood pulp grinding.

From the foregoing tabulation it appears that some 250,000 horse-power of electrical energy is to-day being used in Canada for other industrial uses than those which we commonly see and hear about. This represents a rather large percentage of the total power generated in Canada and due to the high load factor at which this power is taken, there is really more energy taken for these purposes than would appear at first sight.

Arc Heating Processes

By far the largest amount of power used for any of the processes shown above is consumed for arc heating, and in this subdivision calcium carbide and ferro silicon stand in the front rank. The use of arc heating in the manufacture of steel has, however, grown very rapidly, and this use bids fair to surpass even carbide and ferro silicon in its energy consumption within the next few years. For example, in 1915 there was less than 5,000 horse-power used for steel manufacture in Canada, whereas to-day nearly 40,000 horse-power are so used.

Experiments are being carried out at many points dealing with the production of ferro alloys other than ferro silicon, and it is quite probable that this work will lead to results requiring considerably greater amounts of power than is being taken for the production of these alloys to-day.

One of the arc processes which have shown great development during the last year has been the treatment of zinc ores, and present indications are that this process will be of some magnitude in the near future.

Resistance Heating

Most of the processes in which heat is generated by the passage of electricity through the materials making up the product do not require large amounts of energy per unit of product, nor do any of the products made by such processes compare with carbide or ferro silicon on the tonnage produced per year. These processes, therefore, while important industrially are relatively unimportant from the power company viewpoint. It should be noted, however, that these processes, which are mostly used for the manufacture of abrasive materials and electrodes, have been well developed in Canada, and have been of tremendous value in the production of munitions, as abrasives have speeded up munition production to a remarkable degree, and electrodes have permitted the production of ferro silicon, which is essential to the present-day steel manufacture.

Electrolytic Processes

Processes using the electric current for plating or similar work, without using the current for heating, do not in general require large amounts of energy per unit of product, and thus the total use of power for this type of process is relatively small, and will remain so until the tonnages produced become very large. However, the use of electricity for these processes, especially the production of electrolytic copper and zinc, is rapidly increasing, and in the near future much larger amounts of power in the aggregate will be required

A novel use for this type of process has been the manufacture of chlorine in cotton mills and paper mills for direct use in bleaching, rather than the obtaining of bleaching agents by the use of chlorine carried in chlorinated lime.

Combined Electrolytic and Electro Thermic Processes

When the small amount of energy required for actually plating the metal out of an electrolytic bath is increased by the amount of energy required to keep that bath molten at relatively high temperatures, the energy consumption per unit of product is very much increased over the theoretical amount required for plating only. There are two metals produced to-day commercially by this process—aluminum and magnesium—and the amount of power taken for this purpose is very considerable.

Commercial Heating

Due to ease of temperature control and freedom from attention, electricity is being applied to-day in many processes requiring nice temperature regulation, or where relatively small amounts of heat are required in inaccessible places. For example, the lead pots of monotype machines are now heated electrically, with the result that perfect slugs can be obtained at all times and the output per day from such machines materially increased. Again, certain parts of shoemaking machinery require to be heated, and it has been difficult in the past to provide for the heating of these machines when changing from steam to electric power in shoe factories. With the application of electric heat to these machines, however, this difficulty has been removed.

The chemical industries are rapidly finding uses for electric heating in those reactions which require a constant temperature and the input of a fixed amount of heat to the materials undergoing reaction, and this use of electricity will certainly in the future be a very important one.

Regulators

While regulators do not in themselves consume large amounts of power, they, however, when applied to electric furnaces, pulp-grinding machinery, and other apparatus, so increase the load factor that the energy consumption is very largely increased. Until recently it has been quite impossible to get satisfactory regulators for heavy duty, but this problem now seems to have been solved, and regulators are available for handling any commercial load.

General

The above tabulation and discussion of "other uses of electricity" is far from complete, and only covers those particularly large uses of energy which seemed worthy of note, and they are set forth above in order that they may serve as an outline for discussion at the convention, when more accurate and complete data on these and other processes will be forthcoming.

The tremendous advances made in these "other uses of electricity" in the last few years would seem to indicate that in the future by far the greatest portion of the output of electricity will be used for the types of processes covered in this portion of the report.

Respectfully submitted,
Charles T. Barnes.
W. H. McIntyre.
Louis W. Pratt.
H. E. Randall.
Edmund E. Walker.
M. C. Gilman, Chairman.

Discussion

In the course of the discussion, Mr. Dion brought up the subject of electric vehicles. His company recognized the importance of supporting the industry and had purchased some trucks. They were not at all satisfied with the results. They had never, with the way that the batteries were used by the average driver, able to get the results that had been published. It was impossible to use the trucks throughout the year—the trucks were impossible in the winter. This, of course, also applied to gasoline trucks. The company had compromised by using horses and also trucks.

Mr. Hopper also related an unfortunate experience he had with electric trucks, particularly in the matter of renewing batteries. They certainly were not useful where dirt roads had to be run over. He regretted to say that he did not get 25 miles out of one charge of the battery.

Mr. Davies, speaking of the experience in Montreal, declared that in such districts where snow was abundant electric trucks were a failure. The small industrial trucks so extensively used in factories and railway stations, however, had proven a success. Discussing another phase of the report, Mr. Davies said that with diminishing light rates they must get more kw.h. per customer. The difficulty was that the central station was not in touch with the customer.

Mr. Winter remarked on the want of outlets in many fine residences.

Mr. Hyde pointed out that by the use of color schemes in buildings and houses there was an opportunity of increasing the kw.h., because the schemes added to the charm of such places.

Mr. Maclachlan said that good illumination was an important factor in the prevention of accidents and it was calculated that it saved one hour per day per man in a foundry.

Mr. McDougall said that it had been too often left to the contractor and builder to do the layout work, and sometimes these were interested in pushing certain fixtures. To increase the consumption of light an effort must be made to increase the standard of illumination, which was too low.

Mr. Johnson remarked that trouble arose from the fact that contractors and architects were often responsible for the designing of the lighting layout.

Mr. Grier stated that the Council of Architects in Toronto would welcome any gentleman who would address them on the subject of designing a house on the most efficient electrical system.

Mr. Dunlop held that the most promising field for increased consumption was in the greater use of electrical appliances. He suggested that the installation of heavier circuits in wiring residences would be a good thing.

The president said that the central stations were remiss in not having experts who could advise architects as to the field that was open for efficient lighting. Such experts could also give advice to the companies' customers; in a word, the companies ought to give as much attention to illumination as to distribution.

Mr. Randall stated that at Shawinigan Falls 44 houses had been supplied with apparatus for electric cooking, heating, etc., the whole scheme having been worked out very carefully.

Mr. Gilmour related his experience as to cooking for a family of six persons, the cost working out at less than $2.50 per month.

Mr. McDunnough stated that he found that the consumption was 1 kw.h. per day per person. The cost in Quebec was 1c per kw.h. with a flat rate of 60c per month for each burner.

The president said that in 2½ years they had sold 750 electric ranges in Toronto, and only one came back, and that for a special reason.

Mr. Barnes stated that in London the cost of a range to a family was $1.65 per month at a one cent rate.

The Evening Entertainment

In the evening the members of the Montreal Companies' Section entertained the out-of-town delegates to an informal dinner at the Ritz-Carlton. Mr. James Wilson, the chairman of the section, presided, and in the course of the evening intimated that it was intended to ask the N. E. L. A. to hold the annual convention in Montreal. Speeches were made by Messrs. Sullivan, Muldaur, Norris, McDougall, Dion, Davies, and Hiller. A patriotic note permeated all the speeches, occasion being taken of Mr. Muldaur's presence to emphasize the feeling of unity between the allies and the States in the great world fight. Emphasis was also laid on the promising start which had been made in Montreal in the formation of the new section. It was decided to send the following telegram to the N. E. L. A.:

"To our ally not only in the service of science and the public, but also in that of freedom and civilization, the Canadian Electrical Association at its 27th Annual meeting sends all friendly and hearty greetings. Your representative, as always most welcome, has contributed greatly to the success of our gathering."

The arrangements for the dinner and the concert were admirably carried out by Messrs. R. J. Beaumont, P. T. Davies and E. Randall.

The first business at the opening of the convention on June 8 was the appointment of a nominating committee. This was followed by some remarks by Mr. Haskell on the Education Committee Report. He stated that the work was divided into two sections divided by the Ottawa River—Mr. McIntyre looking after the western portion and himself the eastern portion. The work of providing educational courses for men in the member companies was largely directed from the headquarters of the N. E. L. A. Men had to be secured because of the large numbers at the front, and many of these had to be trained for the work. Any man with average intelligence could learn much from these courses. In Montreal there was an educational committee, and it was hoped to make very substantial progress. Member companies who were not in the sections would have to work as separate units and it was essential that one man in each company should look after the work. After July 1 the courses would be restricted to Class B members.

The president insisted that supervision was necessary, so that the courses would be kept up until the end.

Mr. Maclachlan in referring to the returned soldiers, suggested that those who had been injured might be trained in order to be employed at work for which they were fitted. The public utility companies could assist and secure some of the men.

Energy Distribution, Present and Prospective

By Mr. Julian C. Smith

In the few minutes which have been allotted to me I wish to bring to your attention some figures which are now a matter of record, showing the growth in the use of electric energy and the result which it is having, and will continue to have, on the development of electric stations.

As you know, the use of power began in the mining industry in the eighteen hundreds; it was as late as 1840 or 1850 before the development of steam engines had reached any considerable size, and from that time on the development has been extremely rapid.

Naturally, the first development was for each different user of power to instal his own equipment. This was, in fact, practically the only thing which could be done, as the sizes of the prime movers were small, and there was no means of transmitting power from one station to another except by means of belts, rope drives, etc.

About 1880 electric power first began to be used, and ten years later the first alternating current devices began to appear. From 1890 on to the present time, in a space of 27 years, there has been a continuous development on an increasing scale.

Total Power Demands

The total amount of power, excluding railways and steamships, used in the United States at periods of the census taking, are given in the following table. The population of the United States has increased very considerably in this time, but the table also gives the amount of power used under the same conditions—that is, exclusive of transportation and animal power:

Year.	H.P.	H.P. per capita.
1870	2,461,000	.064
1880	3,617,000	.072
1890	6,315,000	.10
1900	15,200,000	.20
1910	23,300,000	.25
1915	30,000,000	.30

I have used the figures for the United States because they are more readily available, and illustrate the same conditions which exist throughout the entire civilized world—that is, that there has been an increased use of power per capita, and that this increase is going on at a high rate, year by year.

The following list shows the total kilowatt hours used per capita per year, as supplied by the electric service companies for all purposes, except railways:

	Kw. h. yrs. Per capita.		Kw. h. yrs. Per capita.
Buffalo G. E.	585	St. Louis	400
P. S. E. Co., N.J.	180	Rochester	450
New York Edison	225	Toronto	700
Brooklyn	225	Montreal	738
U. L. and P. Company .	225	Quebec	200
Philadelphia	250	Entire United States ..	230
Pittsburg	500	Niagara Falls, N.Y. ..	33,000
Cleveland	400	Shawinigan Falls, P.Q.	41,000
Boston	350	Three Rivers, P.Q.	3,400
Minneapolis	450		

In broad lines this indicates that mankind has become more and more dependent upon the use of energy derived from water-powers or steam plants, and with the data at hand we can make a fairly reasonable prediction as to what the conditions are going to be in five or ten years to come. It has only been within the last ten years that the average householder could utilize power of any kind in small units for various purposes in connection with his house or small industry.

Development Through Three Stages

Thus the development has passed through three stages already:

1. The development of small power units driven by steam, which were set up in the individual factories of the power users.

2. The concentration of these units in large units of power, and the consequent concentration of the factory into such single large units.

3. The development of the power business as a separate enterprise, and the distribution of this power primarily for power purposes to different industries.

We now seem to be reaching the fourth stage, and that is the continued concentration of the power development in large units, linked together for purposes of reliability, and the distribution of this power both in large units and in small units to each individual who requires power for any purpose.

To-day in the United States and Canada, in those places where normal industrial life exists, the kilowatt hours used per year per capita amount to about 500. Of this amount 400 kw. hours are used for factory purposes, outside of dwelling houses or residences of individuals, and 100 kw. hours are used for housekeeping purposes, including principally light, and to a lesser extent heat and motive power.

Electric Cooking and Small Accessories

With the increased use of the small accessories and almost certain development of the electric cooking in the near future we may readily look forward to a condition of affairs in five or ten years when the demand for electric power for the individual—that is, leaving aside the industrial or factory use—will increase from the present amount of 100 kw. hours to 300 kw. hours per capita per annum, or an increase, as you see, of 200 per cent. At the same time the industrial use is bound to increase, and there is every probability that in ten years from to-day the use of electric energy will amount to more than twice as much as is used at the present time. This does not mean that every customer is going to take twice as much as he is now taking, but it does mean that, on the average, over a considerable territory, located favorably for manufacturing, that the increased use of power is going on at a very high rate.

The natural question arises as to what may be expected in the manufacture of power and the distribution of power, and this association is vitally interested in the proper solution of this problem.

As regards the manufacture of power, comparatively little time can be spent in this paper. The development of power by means of water-power stations has reached such a high point of efficiency that very little can be hoped for in this regard. The efforts of our engineers and designers for the next few years must be devoted to those features of the problem of hydraulic power development which are involved in the reduction of costs.

The financing of these enterprises must also be improved, so that the total cost of the hydraulic power development can be brought down to more reasonable figures, everything considered. The government authorities can assist in this matter by preventing the duplication of lines and systems and by the proper control of construction work, so that competitive systems cannot be constructed solely for the purpose of stock jobbing operations or for political benefits. It is inevitable in such cases that finally the burden of the increased expenditure must be carried by the population served, with the consequent result that the cost of the service rendered is increased.

The proper control of rates by the government authorities, coupled with protection against competition and the assistance of the government in working out the true economic conditions in the development of these enterprises, is, I am sure, the desideratum earnestly hoped for by the members of this association.

Wild promises made by people who have had little experience in the building and distribution of electric power—that power can be generated for a few dollars per horse power and delivered to isolated farm houses or small communities, at prices very much below those current at the present time—only cloud the situation and postpone the proper solution of these problems.

We may some day see the time when practically everyone will obtain electric power as readily as they now obtain telephone service or the service of good roads, but these problems cannot be solved without due regard to the factors involved, and the sooner that everyone realizes that such factors do exist the closer we may arrive at a solution of one of the most difficult problems which now exists in the sale of electric power in small units.

Cost Estimates

A large hydro-electric power station, financed under good market conditions and protected against the hazard of intense competition, may be constructed in these days for about $100 per horse-power, where the natural conditions are favorable. Usually such a power station is located at considerable distance from its market, and transmission lines are required. Such transmission lines vary, of course, tremendously in cost, depending on the distance, the amount of power to be transmitted, the character of the line, etc., but it would be a fair estimate to assume that such a line can be constructed for, say, $50 per horse-power. This will deliver power from the hydraulic power stations to reasonably large communities at a capital cost of $150 horse-power in the shape of high voltage power. This power must be stepped down—must be fed into a distribution system at perhaps 12,000 volts; must be again stepped down to 2,200 volts, and fed into the usual distribution system which supplies the individual customer.

The cost of this distribution system again is difficult to estimate, except in individual cases, but it might be stated that the 12,000-volt system will cost $50 per horse-power, with its transformers, switches, etc., and the low tension, or 2,200-volt system, with its transformers and low voltage conduc tors, will cost anywhere from $75 per horse power up to $150 per horse power.

Thus the total cost of delivering power from the hydro-electric power station to small consumers located in towns of from 2,000 to 3,000 inhabitants amounts up to $300, and sometimes considerably in excess of this figure.

It should be borne in mind that this represents the actual investment of money, and that if the rate of interest is based on 6 per cent. value of money that the consumer must pay $18 per horse-power, based on his maximum demand, to cover the fixed charges on the investment involved. To this amount should be added the operating costs, which, of course, vary materially, but in the case of small customers would probably be upwards of $10 per horse-power; and, again, there must be added items of insurance and depreciation, amounting to at least 5 per cent. more on the total investment, or $15, making the total cost $43 per horse-power on the maximum demand. Nothing is added in for the actual cost of the power, or the profit, assuming that all of these items combined represent $5 per horse-power, the total cost is then $48 per horse-power.

The load factor is very small on most of this type of business, and consequently the rate per kilowatt hour must be made high, with a guarantee of a certain definite return if the business is to carry itself.

I realize that the figures given above are open to very considerable debate, but even if the figures are modified considerably the final result will, in most cases, arrive at a high figure.

This demonstrates what I have stated above—that one of the most serious problems facing any company engaged in the distribution of electric power is the problem of selling power to the small customer where the density of business is small. As the average customer increases his use of power by taking on accessories, doing his cooking by electricity, the conditions may be benefited somewhat, although, unfortunately, a good deal of new business which will doubtless come on has a comparatively poor load factor, and in many cases laps over the present lighting peaks.

Summary

In conclusion, I would sum up all I have stated above very simply:

1. That we are in the midst of an enormous extension in electric power systems, and we may look forward to doubling the sale of electric energy in the next ten years. A good portion of the doubling will no doubt be in the large users of power, including perhaps the railways, but there will be a very large amount of increased power sold to individuals, due to the fact that the demand for each household using power is going to increase, and the use per capita from this cause alone will represent a very great number of kilowatt hours per annum.

2. The problems of generation and transmission are fairly well solved.

3. The problems involved in the organization of companies, in the reduction of expenses by the elimination of competition, and in the better co-operation of the government control, must all be met and solved successfully within the next few years if the growth we see coming is to be realized in its greatest extent.

4. One of the most difficult problems is the sale of electric energy in small quantities in isolated communities. This is of great importance because of the large number of people interested, and whose demands for such service must be taken into consideration. The problem must be solved by careful study and investigation and by the recognition by all parties concerned that there are serious difficulties involved which necessarily cause the price of electric service delivered under these conditions to be high. The solution of these problems can only be satisfactorily arrived at by the co-operation of all of us, including the customer to whom we sell the power.

Discussion

Mr. Alan Sullivan, at the request of the president, summarized some conversations he had had with eminent electricians in the United States on the subject of future developments in electrical science. These men included Edison, Professor Elihu Thompson, Dr. Steinmetz, Mr. Charles Brush, and Dr. Graham Bell. An outline of these interviews has already appeared in the Electrical News. The general trend of the views were similar, although differing according to the field in which these eminent scientists are working.

Mr. Hyde discussed the possibilities of the utilization and control of different forms of energy, alluding particularly to explosives such as dynamite and glycerine. Under present conditions there was, by the process of explosion, an enormous mass of power unharnessed; might not devices be invented by which these explosive chemicals could be drawn upon as a motive power when required, instead of the entire force being drawn upon at one time? Mr. Hyde also referred to the possibility of constructing central stations for the direction of ether waves in a selective direction rather than in a general one.

Mr. Julian Smith did not consider there was a probability of the use of ether waves as suggested by Mr. Hyde. With regard to explosives, Mr. Smith thought that any progress would be in the direction of utilizing the elements now employed rather than by using explosives. The first use of combustion engines was in the direction of employing explosives, but engineers soon discovered they were on the wrong track. Mr. Sullivan had raised the point as to the utilization of only ten per cent. of the potential value of coal as a heating unit, but Mr. Smith did not share the view that it was possible to develop anything like what was often supposed to be practical, and the utmost he thought feasible to be developed was twice the present heating value.

Mr. Dion, in alluding to Mr. Smith's paper, remarked that the writer was justly optimistic as to the future requirements of power in this country. We should have to rely on hydraulic power as the main source of energy. It was extremely regrettable to notice the trend of events in the matter of power companies and investors, particularly in Ontario. He believed that if those responsible for the movement had got together with the companies and had suggested government control rather than competitive schemes a great deal of trouble would have been avoided. Perhaps it was a case of obstinancy on both sides and there did not seem to be any remedy. While it was too late in Ontario, there were other provinces, and he suggested that investors might be protected in their holdings by legislation, at the same time the public being protected from any unfair demands by the companies.

Mr. Fee spoke of the danger to water powers from forest fires, and said that it was essential to look ahead in this matter so as to protect the limits.

Mr. Milliken thought that there was a great opportunity to utilize waste fuel and also to turn the products from the coke ovens into valuable commodities.

Mr. Peterson drew attention to the subject of parallel lines of telegraph and telephone companies and power companies and the interference which resulted to the former lines. He said that a great deal had been done in the United States to eliminate such interference with telephone lines, and it would be a great help to the telephone companies if first hand knowledge were given them of the intention of the power companies to build transmission lines paralleling trunk telephone lines.

Report of Committee on Rate Research

By Mr. P. T. Davies, Chairman

This committee, which is the counterpart of the N. E. L. A. Committee of the same name, was created by the President and Executive Committee to bear a similar relation to the C. E. A. to that which the National Committee fills to the parent body, the N. E. L. A.

This direction opens up a large field of endeavor for this committee, and it is difficult to make a start on any particular line of research until this field has been surveyed and plotted and thorough consideration given to the whole question, so that the elements which will prove of immediate value can be investigated first and those which deal only with gradations and niceties left until the main considerations are given a general study.

The question of rates is perhaps the most important of all questions, since without profitable rates no company can progress, and without equitable rates no company can be of full service to the community which it supplies.

Rates, again, are the primary cause of friction between the public and the central station company, and if complicated do more to cause criticism, just or unjust, than any other contact point between the parties thereto.

Rate-making, since the beginning of the commercial supply of electricity, has proceeded almost at the whim of the central station manager; if a company is profitable it is taken as a criterion that the rates are well chosen; if otherwise the reverse holds. The pendulum has swung from flat rates to meter rates, from meter rates to mixed rates, and from mixed rates to rates which require an accountant to render and a comptroller to check—it might well be said, "In the making of rates there is no end."

Lastly, before we proceed to outline the field of endeavor laid bare to this committee, let it be postulated that the growth of business absolutely depends on well chosen rates, as without attractive rates business comes but slowly.

It will be seen that the field is a very large one, and that each and every branch and leaf on the Rate Research tree is capable of research and investigation. In view of this variety and the short time at the disposal of the committee, we feel that we can only suggest the most pressing topics for investigation and comment briefly on the problems thus chosen. Taking the main branches in order we find the following the most important:

CONTRACTS

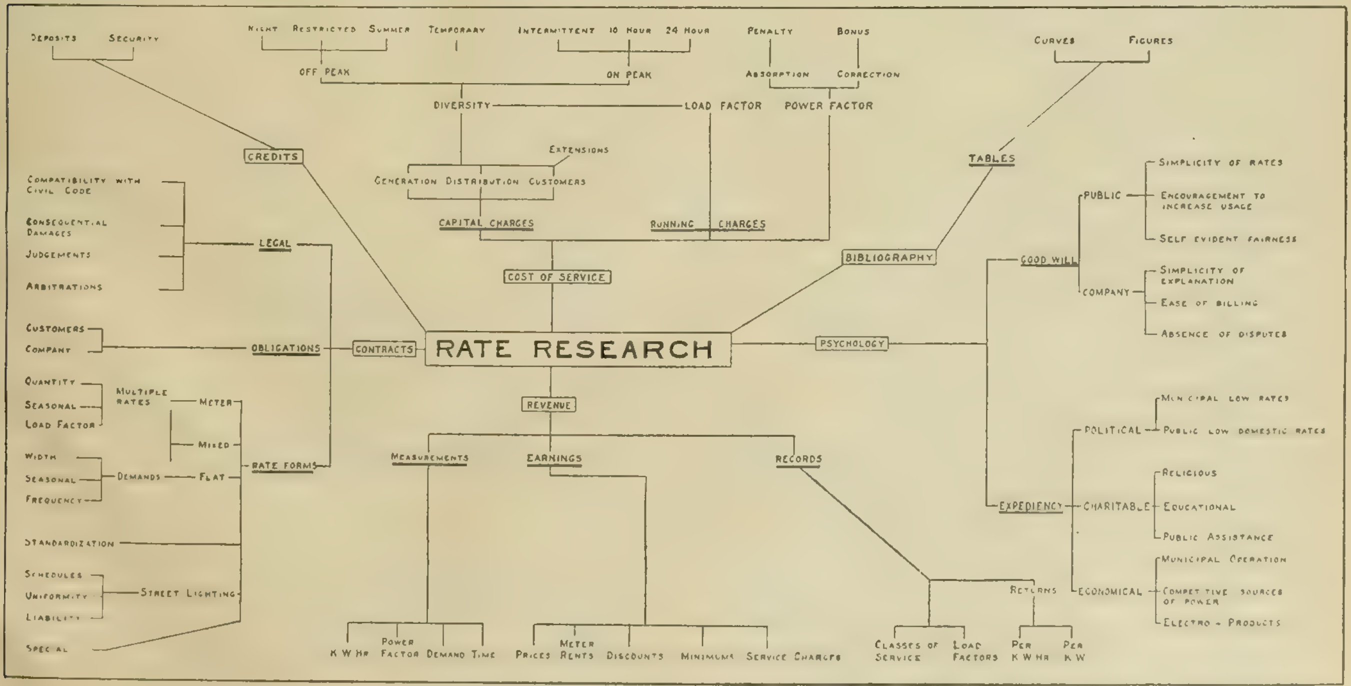
Legal—Consequential Damages:

The progress of the art is not such that it is possible to provide against interruptions, the claims of customers for damages through loss or deterioration of product which damages bear no relation to the price of services, can have no basis in equity nor should any responsibility for consequential damages be considered by companies under any condition whatsoever.

Competitive sources of power are just as liable to interruption, and in accepting service customer also accepts any risk of interruption which is present. A standard form of non-liability clause should be included in all contracts, and the following is a form which is used by one of the larger companies:—"The company does not guarantee a constant supply of electricity and shall not be liable for any damages to the consumer in consequence of its failure to supply electricity at any time or times."

Rate Forms—Standardization:

It would be a good thing if rate forms for similar classes of service could be of the same type in various parts of the country. All of us are familiar with the difficulties experienced in dealing with a new customer from another part of the country who is accustomed to a rate form which is not included in the rates available; a difference in price is not difficult to explain as the prices of many things vary with location, wages, etc., but a totally different form of rate,



Rate Research tree to accompany Mr. Davies' Report not easily understood by customers, is more difficult to explain, and creates a feeling of distrust which no explanation will eradicate.

Demands:

There is at the present time an absolute lack of uniformity in the definition of what constitutes a "Horse Power"; in some cases a twenty minute average load is taken, in others a five minute average load, in some cases three demands per month, in others a single demand.

The width of demand taken, especially in flat rate contracts, is a determining factor in the revenue obtained from any service, and while in some cases such as water pumping, refrigeration, flour milling, textile mill driving, street lighting, and to a lesser degree shell machining on large installations, the demand taken over a short period does not differ much from a demand taken over a fairly long period; in other cases, such as hydraulic presses, air compressors, rock crushers, mine haulages, etc., the demand is a constantly fluctuating one, reaching maxima of short duration with regular frequency which if taken over a long period would not represent the capacity which has to be furnished to supply such demands.

Again, in other cases, such a elevators, electric furnaces, and many industrial loads, the extreme maxima may be reached infrequently and be of short duration when demanded. Generally speaking, the central station company has the right to regard the question from two points of view: first, the reserve capacity for overloads existing in the plants supplying the demand, second, the amount of plant which would have to be installed by the customer to take care of the demand if the load were carried by an independent plant.

The committee proposes to collect data on the question of the characteristics of the demands taken by different industries which central stations supply, anticipating that such information may be of use to the members in providing data upon which rates can be based.

It has been suggested that steady loads are best rated upon long demand intervals, and fluctuating loads upon short intervals, but while on the face of it this may appear fair, it is open to the objection that the steady load with high diversity is penalized.

Undoubtedly where water storage is possible or where the system is large compared to the demand to be rated this solution is open to criticism and the committee would be glad of full discussion of this question.

Another solution is to abandon flat rates altogether, and substitute mixed rates with a flat rate portion of the charge producing only 30 to 50 per cent. of the total revenue; under these conditions the question of peak period can be more easily standardized as a short peak period will not unduly penalize any customer, and a low load factor, i.e., of high diversity, will be taken care of equitably by the meter rate portion of the charge.

REVENUE

Measurements:

Instruments for the determination of demand have been slow of development, and this committee has no doubt that all companies suffer from lack of same. The instruments required can be divided into two groups—those required for small loads, say up to 50 horse power, and those required for larger loads. The requirements for small loads are low first cost and low operating costs—for large loads companies are warranted in obtaining high class instruments and employing specially trained help for watching and calibrating the instruments used.

While there are now obtainable a few instruments for small loads filling the above requirements they are all of a type which register current only, and leave a record of only one demand without indicating the time at which the demand occurred. There is without doubt a great need of an instrument for the small load, and the lack of same has forced most companies to the expedient of depending on haphazard tests or of taking the rating or some fraction of the rating of the apparatus connected as the basis of charge for the flat rate portion of the account.

For the large customers many excellent graphic meters are obtainable. These, however, are open to the objection that a fluctuating load cannot be accurately integrated, and also the record is very bulky and the instruments require continual attention.

There have been developed recently graphic meters on the Merz principle which show the kw.h. used during successive intervals. A record for a week showing the kw.h. used every fifteen minutes can be obtained on an eight-inch chart or on a strip chart 24 inches long, and the necessity of integration is done away with, while the accuracy of the instruments is wholly dependent on the integrating meter by which it is operated.

The attention of members is directed to the report of the Meter Committee, which gives full data on these meters. Even here, however, there is one thing lacking on the record, which is power factor, and there is still room for an instrument which will graphically record the kw.hrs. and kv.a. hrs. on the same chart or on synchronized charts. An instrument of the kw. demand graphic type with a second pen charting the kv.a. has been produced, and a description of it will be found in the report of the Meter Committee of the N. E. L. A., 1917, not yet published. The meter is quite elaborate, but its production is a step in the right direction.

COST OF SERVICE

Temporary loads:

The tremendous demands created by the war on the central station have produced a problem in rate making which requires careful consideration, While the central stations have a patriotic duty to perform in trying to accommodate all loads offered, nevertheless, where such demands require the installation of generating plant and lines which are liable to be idle when the demands are lessened and when such extensions can only be purchased at supernormal prices, and will be depreciated from 50 to 70 per cent. when prices become normal again, it is obviously the part of the customer to pay either in the rate or as a separate item at least the depreciation plus the interest on such capital as will have to be carried idle for the period after the demand is withdrawn until normal business again requires such extensions.

If this is not done companies are liable to be faced with lower earnings and higher fixed charges after the war. Broadly speaking the rate should cover the investment required in all cases plus a fair profit, and if this cannot be obtained the business will be well refused.

PSYCHOLOGY

This division of Rate Research is one which may appear hardly a function of a committee of an electrical organization, but the modern trend of thought is all toward the scientific study of cause and effect, and some problems of rate research can hardly be classified under another head.

Good Will

There can hardly be any question that simplicity of rate form is the sine qua non of rate making, but still, from time to time complicated rate forms are evolved which give the customer the feeling of taking a step into the dark unknown when he signs his name to the contract form. Technicians and experts, too, often make rates which are far beyond the comprehension of customers, and while such forms are possible of application between expert and expert, they savor too much of the methods attributed to autocracy for dealings between public service corporations and their customers.

Expediency:

This again is a question which will bear discussion, and one which should not be hidden under a bushel.

The central station has a duty in the community to promote mutual growth, and if the granting of a low rate to an industry will foster that industry bringing in its train increased population and wealth to the community and incidentally new customers for the company from whom they can obtain their regular profit, then the central station company can afford to serve that industry at almost cost price to the mutual well being.

Again, where the cost of energy is the critical factor in the success of the enterprise, i.e., electro product manufacture—a low rate is justifiable, but where the cost of energy is an incidental cost in a highly profitable industry the central station has a right to a good profit in the same way that it is axiomatic that good wages are the legitimate reward of successful employees in a successful company. In a sense a central station company is also an employee of all users of its product, and as such is entitled to some share in the profits.

Charitable:

With reference to low rates for hospitals, schools, etc., it is an understood thing that no one wishes to make an ordinary profit out of such institutions inasmuch as they represent the manifest desires of the community to promote its well being, so therefore, there should be no disposition on the part of the stockholder per se to take a profit indirectly through his holdings in a central station company.

The committee trusts that a full discussion will be given by members on the questions raised, and would appreciate direction by the members as to what problems members have which they would like the committee to investigate.

Respectfully submitted,
P. T. Davies, Chairman.
Jas. B. Woodyatt.
H. E. Randall.
A. A. Dion.
M. C. Gilman.

Discussion

Mr. Randall told of some studies he was making into the question of the maximum net returns and lighting rates. He was of opinion that there was some point where the stimulated consumption due to the low rate per kw.h. had more than overbalanced the higher rates, under which business was naturally restricted. He had plotted 200 places in Canada, and as the result of the curves found that the points to which he referred was between a 4½ and 6½c rate.

Mr. Gilman recounted the steps taken by the Toronto commission in the matter of tested and other demands in order to get business. His company had never billed customers on a sustained demand. They were considering bringing out a power rate which would be based on connected load rather than a maximum demand.

The president, Mr. P. T. Davies, and Mr. Maclachlan also took part in the discussion.

Illumination

In the course of an address on "Illumination," Mr. Ward Harrison, of the National Lamp Works, Cleveland, remarked that the first goal of artificial light was to make it as satisfactory as daylight, and that goal was nearer realization than many supposed. There were a few installations that could be compared with daylight. Any efficient and economic installations of electric light were naturally accompanied by brilliancy and intensity which made it hard on the eyes. Reflectors had no doubt somewhat modified this condition. Many installations had been put in where the light was equal in brilliancy to that of daylight, but had failed to give satisfaction. They must secure something like daylight diffusion if they were to have the daylight efficiency of light. Present installations were too hard on the eyes. There were two classes of light—one where the people looked at it casually and the other where people were working under it. The contrast in the former was 1 in 1,000 and the other 1 in 100. In shops where polished steel was dealt with the light should be better diffused than in, say, a woodworking plant. In certain cases direct lighting combined with indirect lighting was more satisfactory for factory purposes than totally indirect. Where totally indirect lighting had been tried it had not met with anything like the success it had in offices. Mr. Harrison gave details of experiments carried out at Cleveland with a view of obtaining particulars of the cost of lighting plants, in the case of night work. His company secured hundreds of measurements of illumination by photometer in various classes of factories. It was found that on an average judgment had been used in placing machinery. In one automobile factory there was small variation in the horizontal and vertical illumination, and this was due to the saw tooth form of roof.

Officers for 1917-18

Subsequently a meeting of the members of Class A was held at which the following officers were appointed: President, Mr. D. H. McDougall; 1st vice-president, Mr. J. S. Norris; 2nd vice-president, Mr. E. A. Dunlop; third vice-president, Mr. Monro Grier. Managing committee—president of N. E. L. A. and Messrs. P. T. Davies, M. C. Gilman, Jas. Gould, H. M. Hopper, E. L. Milliken, L. Pratt, J. B. Woodyatt, W. H. McIntyre, R. J. Beaumont, A. P. Doddridge, H. E. Randall, P. Ackerman, C. S. Bagg.

[Mr. P. Ackerman, Toronto Power Company, read a paper on "Instantaneous Selective Relay Protection for A.C. Transmission and Distributing Systems," which will appear in full in our issue of July 1.—Ed.]

Big Plant of the Laurentide Power Company

(Concluded from page 64)

companies take delivery of the power in the station of the power company, thereby relieving the power company of any expense in connection with the construction of transmission lines, etc. At the present time these contracts are in force to the extent of 25,000 horse-power delivered to the Laurentide Company, and 30,000 horse-power to the Shawinigan Company, a total of 55,000 horse-power. This amount will increase steadily so that by the middle of 1918 the Laurentide Power Company will be delivering at least 75,000 horse-power, and after that date it is expected the load will increase rapidly to the full amount of 125,000 horse-power.

The Laurentide Power Company has made an arrangement with the Shawinigan Water and Power Company by which the latter company undertakes the operation of the power plant, thereby giving to the Laurentide Power Company the wide experience of the Shawinigan company, as well as any necessary assistance from its engineering staff, which may be required in connection with the operation of the plant. The ownership of the Laurentide Power Company is vested largely in the Laurentide Company and the Shawinigan Water and Power Company.

The fundamental conditions for a successful hydro-electric development are clearly at hand at the plant of the Laurentide Power Company, i.e., moderate capital cost, an ample supply of water, a practically constant head, and a plant built on the most modern designs and founded on solid rock.

Big Plant of the Laurentide Power Company

Turbine Capacity of 120,000 Horse Power, in Six Units—Vertical Type Generators, Kingsbury Bearings—Transmission at 57,000 and 100,000 Volts

We illustrate herewith a number of the construction features of the Laurentide Power Company, Ltd. This company was organized by letters patent of the Dominion of Canada, with ample powers for the development of water power. The water rights include the ownership of the original Grand'Mere Falls, as well as the ownership of two falls located higher up the river, and rights for the location of dams, flooding of lands, etc. The water powers involved are all owned in fee simple by the Laurentide Power Company, Ltd

The site of the power plant is on the St. Maurice River, at Grand'Mere, P.Q., a point midway between Montreal and Quebec, and some thirty miles north of the St. Lawrence River. The St. Maurice River, one of the largest rivers in Eastern Canada, has a drainage area of 17,000 square miles. With the exception of the power development of the Shawinigan Water and Power Company at Shawinigan Falls, eight miles below Grand'Mere, the development described herein is the largest on the St. Maurice River.

A small development of 25,000 horse-power has existed at Grand'Mere for some thirty years, the whole power from this development being used by the company now known as the Laurentide Company, Ltd., formerly "Laurentide Paper Company, Ltd." On January 1, 1916, the Laurentide Power Company, Ltd., purchased from the Laurentide Company, Ltd., all the water rights, lands, machinery, etc. covering the water power and development at Grand'Mere, and in the St. Maurice River above Grand'Mere, appertaining to this development.

The development consists of a concrete gravity dam about 1,800 feet long, divided into sections. This dam is located along the crest of the Grand'Mere Falls. The control of the water-levels is obtained by the use of eighteen sluice gates, 40 feet in length by 18 feet in height, and operated by a moveable crane from the top of the dam. These gate-openings, with certain auxiliary openings in the power-house, etc., have sufficient area to permit of a maximum flow of 200,000 cubic feet per second, with a depth of water over the crest of the dam of 18 feet. The maximum height of the dam is about 60 feet. The dam, power-house, and all permanent structures are located on solid granite foundations.

Storage

The St. Maurice River at the present time has a minimum flow of about 8,000 cubic feet per second and a maximum of 175,000 cubic feet per second. When the storage works now being carried on at La Loutre are completed it is anticipated that the minimum flow will be increased to about 15,000 cubic feet per second. The available head at Grand'-Mere at low water is 84 feet, and with this head the possible power development at Grand'Mere, taking into consideration the ordinary fluctuation of the load, is about 150,000 horse power.

One of the outstanding features of the development at Grand'Mere is the large lake formed by the dam. This lake has an area of nearly ten square miles, and the back-water extends for a distance of some twenty miles above the power development at Grand'Mere; the large amount of water impounded by this lake will greatly facilitate the economical use of the water.

The power-house building consists of a steel frame, with brick walls, standing on a concrete sub-structure 150 feet long by 180 feet wide. It is completely equipped with all the machinery and apparatus for six water-wheel units, and partly completed for three additional units. For these three additional units provision has been made by leaving openings, providing the gates, etc., in the bulkhead wall, and building up the foundations to a point just below where the water-wheels will be located. The building is provided with ample space for transformers, oil circuit breakers, high-tension and low-tension bus bars, etc. The gatehouse, located just above and in the rear of the power-house, and covered by the same building, is fully equipped with gates and rack-operating mechanism.

Turbines

Water-wheels and auxiliary machinery were manufactured and installed by the I. P. Morris Company. The turbines are of the vertical shaft, single runner type, installed in scroll cas and draft tube, moulded in the substructure. The turbines are rated at 20,000 horse-power each under a head of 78 feet, and operating at a speed of 120 revolutions per minute. These machines are controlled by automatic Lombard governors, provided with electrical devices for regulating the speed from switchboard.

Generators, Etc.

The six generators are vertical units of 16,400 kv.a. capacity, three-phase, operating at 6,600 volts, 60 cycles. Each generator is equipped with its own exciter machine. Below the exciter and above the rotor of the generator is a thrust bearing of the Kingsbury type, the whole load being carried on a film of oil. The electric current on leaving the generators passes through oil switches mounted on a gallery just behind the generators, and from that point to the low tension buses through to the transformer room, where are located three 9,000 kw. transformers, which change the voltage from 6,600 to 100,000 volts. At this voltage power is transmitted to Shawinigan Falls, where it is fed into the system of the Shawinigan Company. An additional bank of three 9,000 kw. transformers is now being installed. Another bank consisting of three 5,000 kw. transformers, changes the voltage from 6,600 to 57,000 volts, at which voltage it is transmitted to Quebec, Three Rivers, and other points.

The usual equipment of lightning arresters, automatic relays etc., is provided. In order to provide against failure of the direct connected exciters two motor-generator sets are installed, which can be used in case of necessity. The switchboard or control room is located at the top of the building, in the west end, where the control of the entire station is centralized. The six generators, with switching equipment and Tirrill regulator, circuit breakers (reactance type "C"), resistance coils, etc., were supplied by the Canadian Westinghouse Company.

The Illustrations

The illustrations herewith, which we reproduce through the kindness of the Laurentide Power Company, show the main features of the work. Fig. 1 is a general view of the plant, discharge side; Fig. 2 shows a cross-section plan of the power house; Fig. 3 shows a closer view of the intake side; Fig. 4, the dam and regulating gates at Grand'Mere; Fig. 5, generator room; and Fig. 6, the switchboard room.

On January 1, 1916, contracts were entered into with the Laurentide Company, Ltd., and the Shawinigan Water and Power Company for taking the entire output of the Laurentide Power Company. Under these contracts the purchasing

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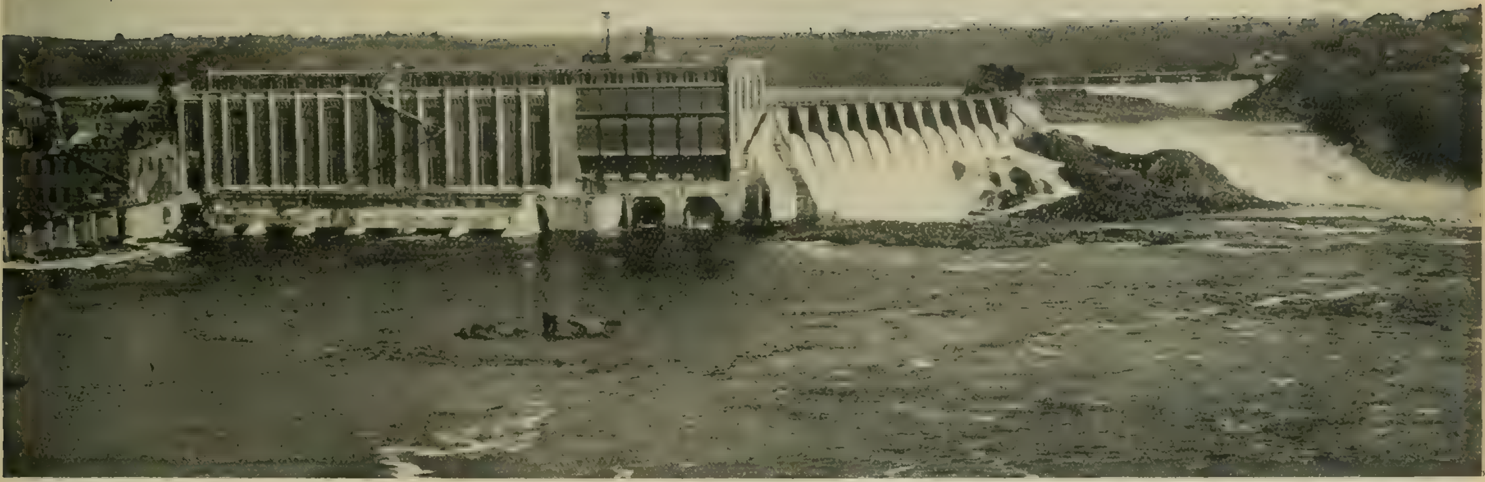


Fig. 1—Plant of Laurentide Power Company, Limited

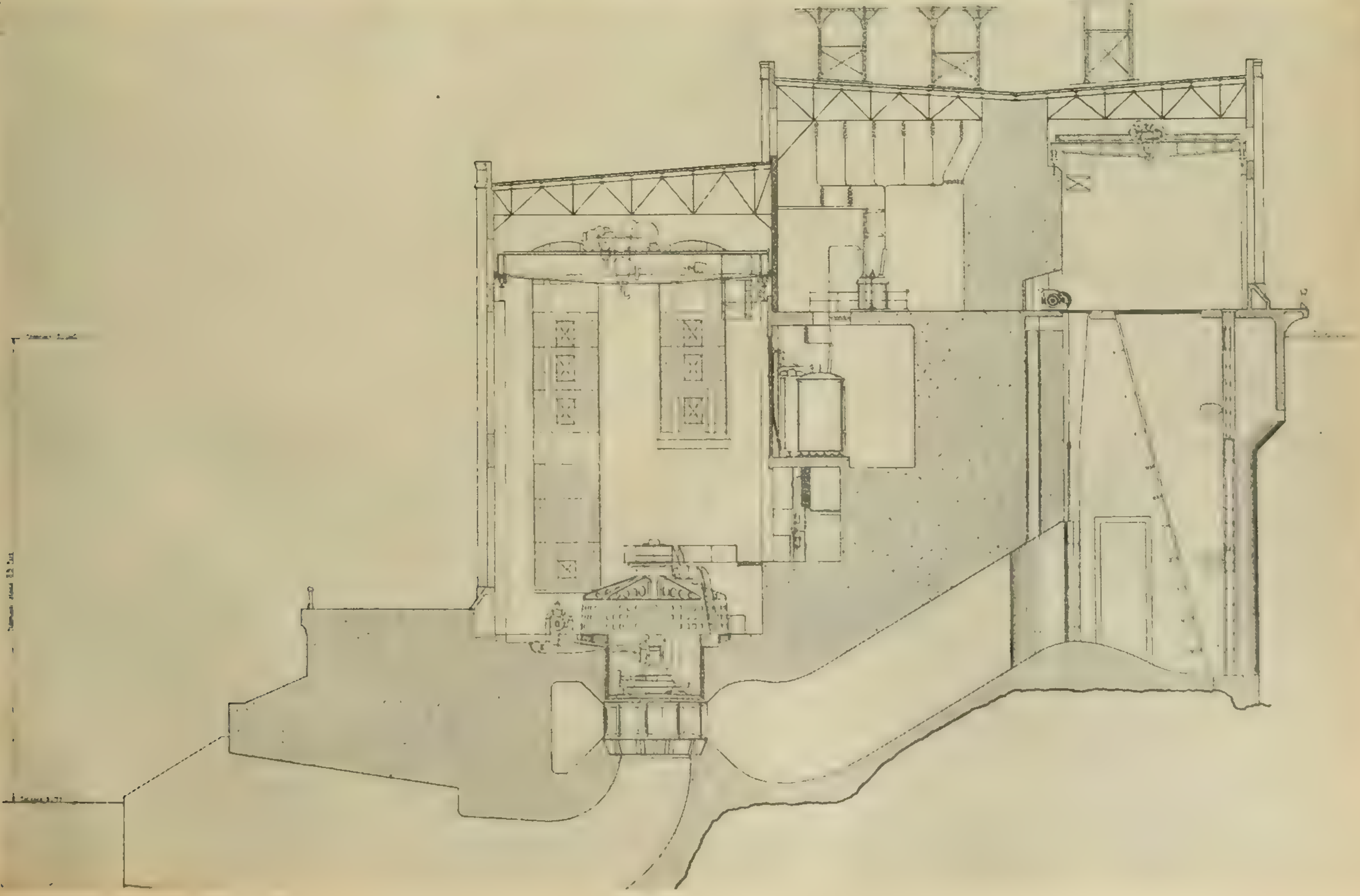


Fig. 2—Cross Section Plan of Power Station

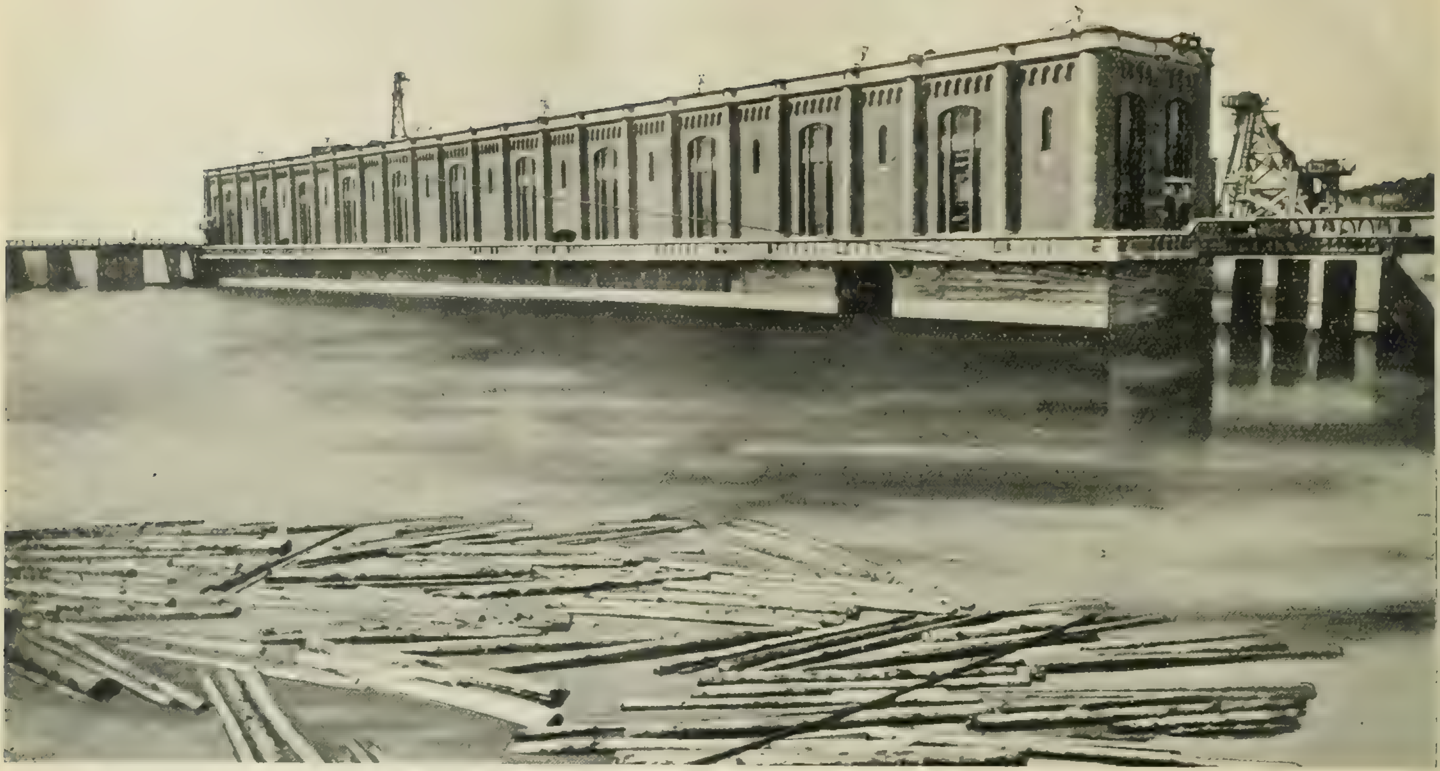


Fig. 3—Upstream View of Power House

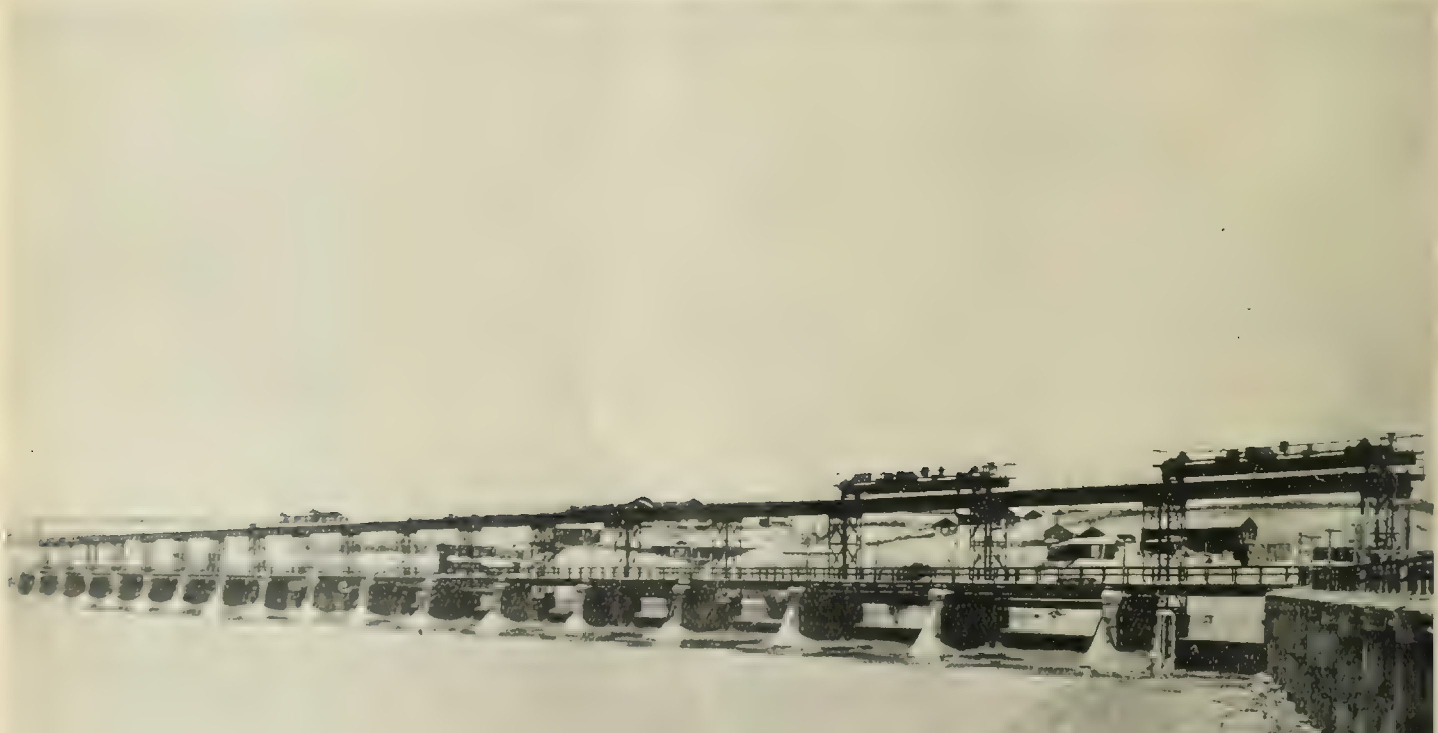


Fig. 4—Regulating Gates on Dam, Grand'Mere

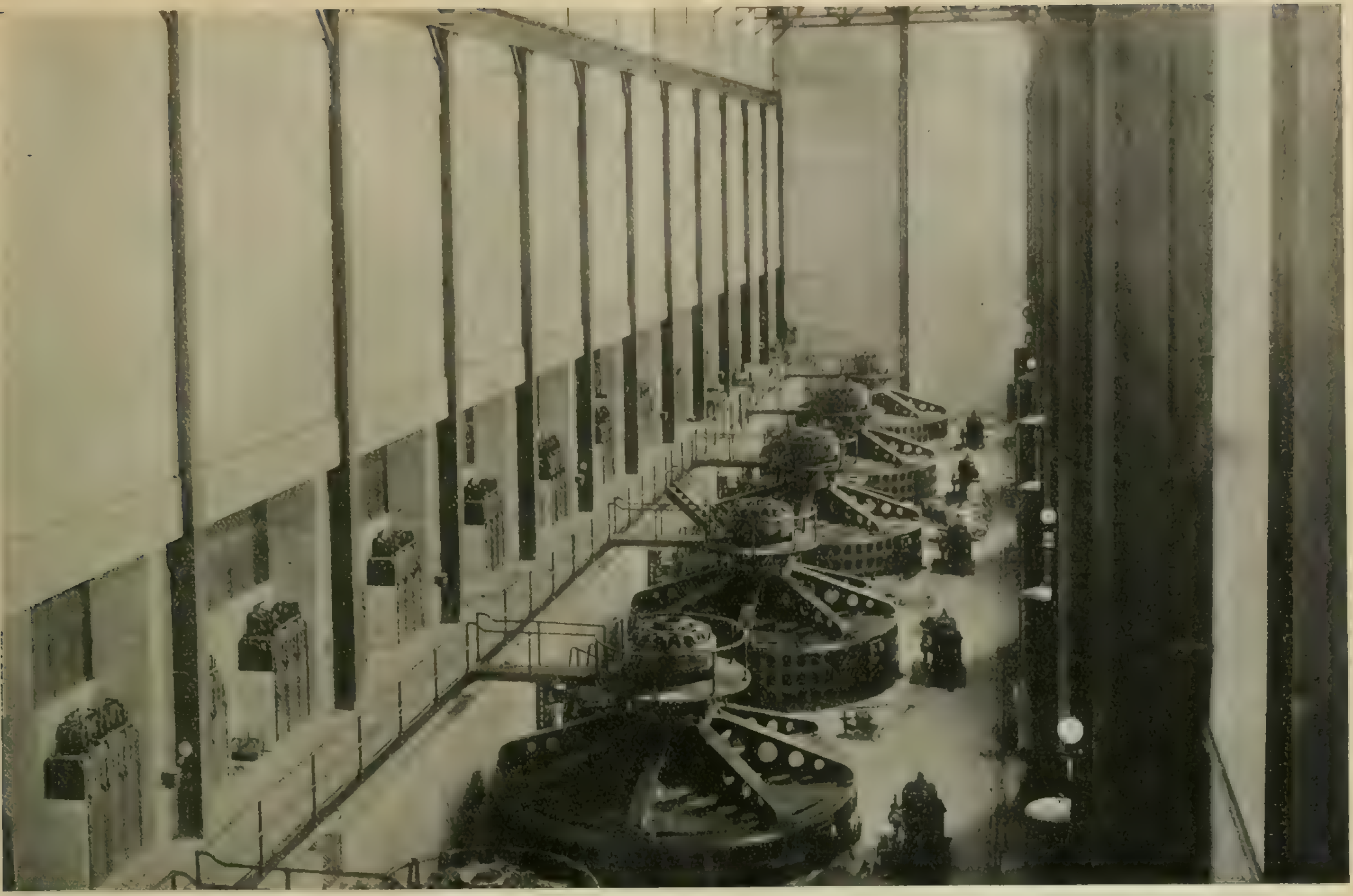


Fig. 5—Generating Room—Power House

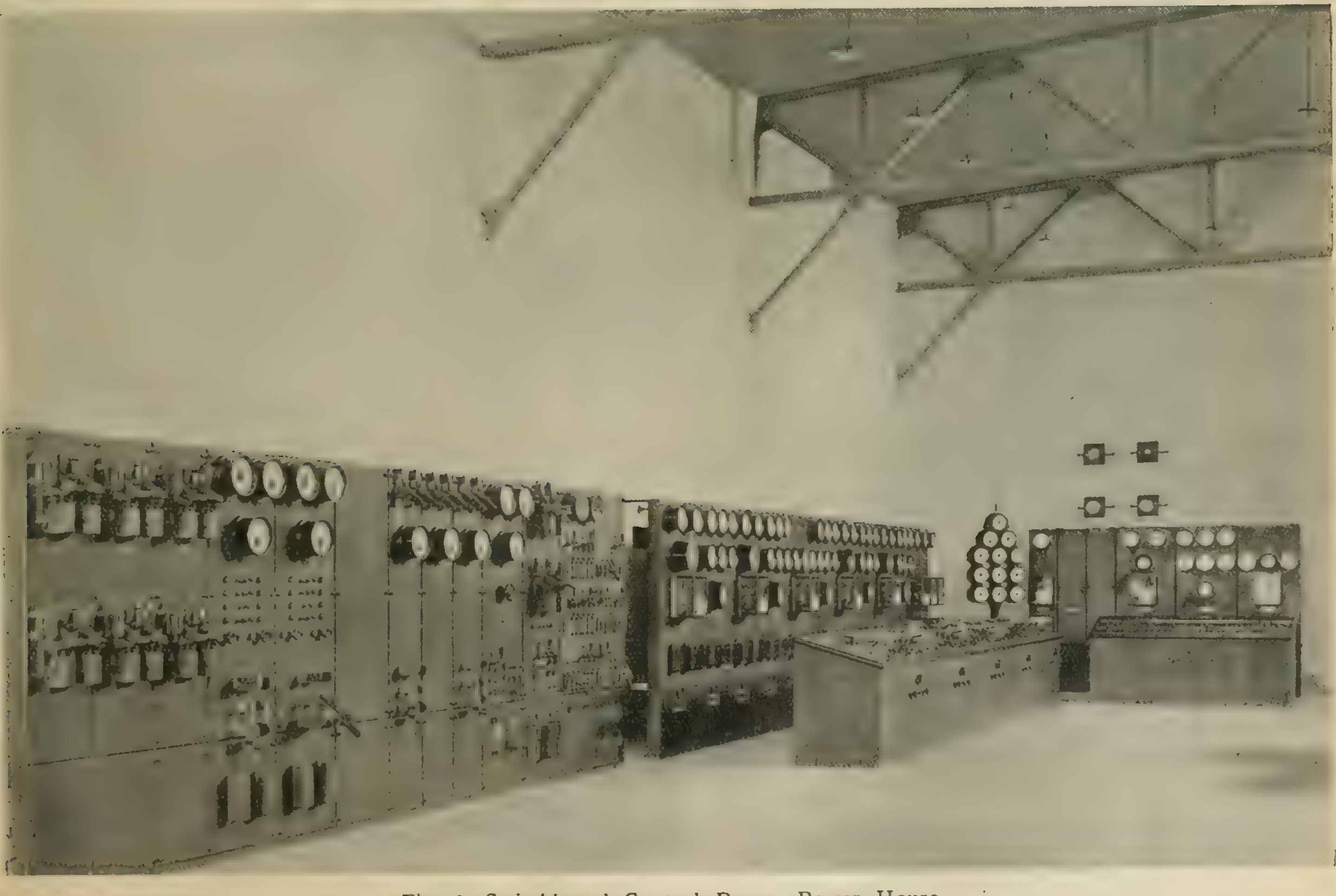


Fig. 6—Switchboard Control Room—Power House

Modern Conduit Construction

As Exemplified by Recent Extensions on the Toronto Hydro-Electric System

The Toronto Hydro-Electric System recently completed two and one-half miles of underground conduit, connecting up the new plant of the Imperial Munitions Board, Ashbridge's Bay, with the Strachan Avenue sub-station. The new conduits are on King Street, between John Street and Spadina Avenue, and on Wellington, from Strachan Avenue to Bay Street, and Jarvis Street to Cherry Street. The work was started on February 22 and completed on May 1. So far as we know, this is a record for conduit construction, as the average exceeded the placing of 10,000 duct feet per day, or approximately 500 feet of trench excavation, conduits installed and trenches refilled. This is all the more remarkable considering that at the time the work was commenced there was four feet of frost in the ground in certain places. A considerable amount of frost was taken out of the ground by building fires along the line of trenches.

The conduit system consists of a 24-duct run. On King Street clay conduit is used, and 4-inch fibre on the balance of the work. One of the illustrations (Fig. 1) herewith shows the installation under way. The ducts are placed in six layers of four ducts each, each duct being separated by 1¼ inches of 1:2:4 concrete. This same figure (Fig. 1) shows the combs used to properly space the conduit and to serve as guides for the depth of concrete covering each horizontal layer. In the manufacture of the concrete good sand was not available, so fine crushed stone dust was used for this purpose, with highly satisfactory results.

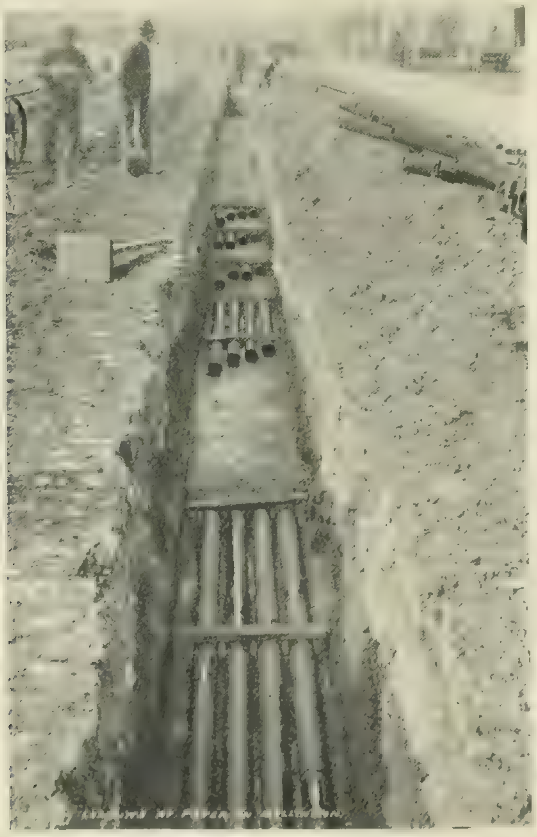


Fig. 1 -24 4' fibre duct, 1¼" spacing between ducts.

Unusual obstacles were met with in this work from other underground installations. For example, at one corner—John and Wellington Streets—four manholes had to be constructed, owing to the large amount of obstruction met with. This corner is shown in one of our illustrations (Fig. 2), where two manholes are seen—one showing the ducts in a 4 x 6 arrangement; the other in a 6 x 4 arrangement, the difference in grade indicating the height of the obstacle that had to be overcome. At different times it was necessary to make considerable offsets, which were frequently accomplished by varying the shape of manhole, as shown in our illustration (Fig. 3).

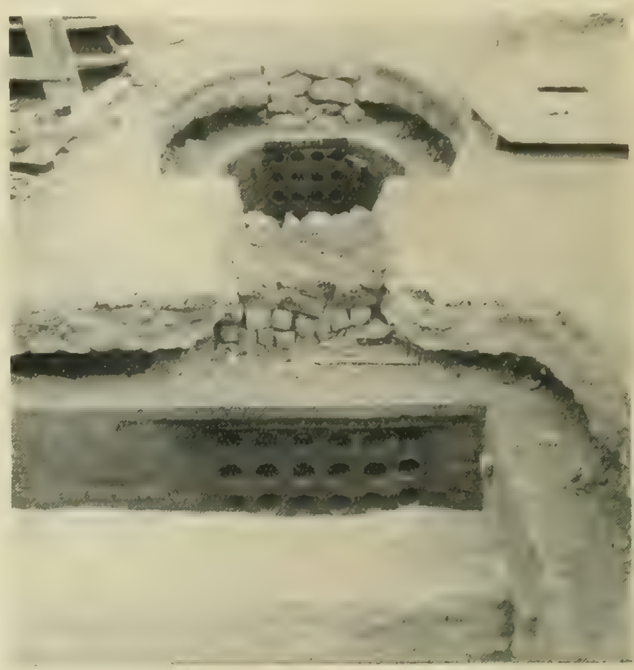


Fig. 2 –Two man holes necessary on account of obstacles.

Brick manholes were built throughout, as being more easily and safely constructed at the time of year this work was undertaken.

The work of installation was carried through by G. M. Gest, Ltd., the conduit was supplied by the Fibre Conduit Company, Orangeburg, N.Y.; cable by the Eugene F. Phillips Electrical Works, and concrete material by the Rogers Supply Company.

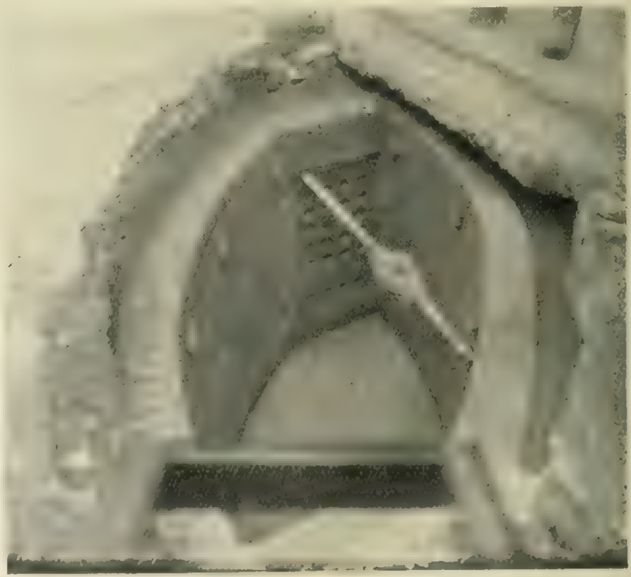


Fig. 3 –Offset manhole changing course 4 ft. to right.

Electric Railways

Light-weight Cars for One-man Operation Have Established Their Value—Fewer Accidents, More Frequent Service, Lower Operating Costs

It is often difficult to foresee the exact line along which development in any activity will take place, and this has been no less true in electric railway operation than in any other public service. No one foretold the prominent position occupied to-day by the light-weight, single-truck car capable of operation by one man. We had looked for solution of troublesome problems to the trackless trolley, the motor bus, the jitney and what not, with little success. To-day, however, it seems a recognized fact that "Safety" cars, as they are coming to be called, have kept many a small railway system and many a branch line of a large system from becoming a dead, unprofitable weight on the shareholders.

An Unfortunate Name

It is unfortunate that such a promising innovation should be given such a misleading name at the christening, as "One-man" cars. It is true they are capable of being manned by a single employee, but this is only one of many new features associated with these cars and perhaps one of the least important. They cost less to purchase, less to operate, maintain a more frequent schedule, any of which characteristics might possibly have influenced the pseudonym, but the real outstanding feature, of importance alike to the public and the company, appears to be its safety factor. All experience goes to prove that with the undivided responsibility which this type of car necessitates, there are materially fewer accidents than with the two-men cars. A more appropriate name would thus seem to be the "Safety" or the "Accident Prevention" car.

This fact of safety to the public in operation has been borne out by a number of recent experiences, some of which have been related before technical societies. For example, Mr. Raymond H. Smith, vice-president of the Eastern Wisconsin Electric Company, speaking before the Wisconsin Electrical Association in March of this year, states that "Apparently the one-man car has not developed any new class of accidents, and it is generally conceded that the undivided responsibility of the motorman is conducive to the reduction of accidents. The absence of the second man to secure witnesses in case of accident is not regarded as important." And again, in the same address, Mr. Smith says: "As to safety of operation, the writer has heard of no incident where the use of but one man has resulted in an accident."

Another testimony to the accident prevention features of this car was given recently by the J. G. Brill Company, who tabulated the results on fifty railways, representing about forty per cent. of the companies operating this type of car in the United States and Canada. The Brill report was strongly in favor of the one-man car. Platform accidents were either reduced or there were none at all. Other accidents were rare and their number was reduced. No new kinds of accident were reported. It was practically the unanimous opinion of the fifty electric railways that the undivided responsibility of the motorman tended to reduce accidents.

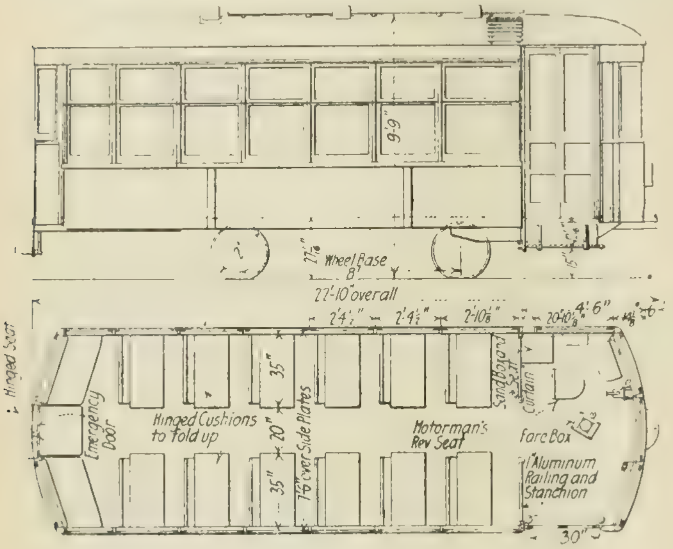
Attitude of the Public

The name, "One-man," is also unfortunate for other reasons. One of these is that it rather intimates, both to the employees and to the public, that the company is working some scheme for cutting expenses by giving less service. The support of the public, however, is essential to the success of these cars and it would undoubtedly be found advantageous by any company or municipality anticipating the installation of this type of rolling stock if a little education towards acquainting the public with the good points of such a service preceded its actual installation. That public opinion, however, after a little experience, is favorable for the most part to this new type of cars is pretty amply borne out. Mr. Smith, in the address mentioned above, speaking of an inventory he had taken of the opinions of 48 companies, has this to say: "As to the bugbear, public opinion, 36 companies report the public to be favorable, 2 companies report the public prefer one-man cars, 4 report no complaints, 3 report some objections which disappeared later, 2 report public indifference, one reports that the public tolerates it, and one, that the public is opposed to it." Criticism at first in a number of cases is reported as later changing to approval. "In general," Mr. Smith states, "the one-man car must be made to look to the public like a development—an advanced idea, and something to be admired. Many an operator has made the mistake of beginning one-man operation with improper equipment and as the first impression is always the most lasting, a mistake of this kind is unfortunate."

	Weight, pounds	Length over bumpers, ft.-in.	Seating capacity body	Wheel diameter, in.	Motors	Rigid wheelbase, ft.	Remarks
Puget Sound	10,000	22–10	29	24	Two 21-25 hp.	8	Single-End.
Tucson, Ariz.. ..	11,000	27–6	28	26	Four 7 hp.	8	Truckless, Loose wheels.
New York Railways..	12,200	28–9	34	21	Two 8 hp.	7½	Center-entrance, Storage battery.
Sedalia, Mo.	13,900	30–1	28	24	Two 21-25 hp.	9	End Platforms.
Austin, Texas	14,300	30–1	28	24	Two 21-25 hp.	8½	End Platforms.

Weights and dimensions of ultra-light cars for one-man operation.

An interesting opinion on this same point was also recently expressed by Mr. C. D. Cass, general manager, Waterloo, Cedar Falls and Northern Railway, before the Illinois Electric Railway Association. Mr. Cass states that, "an important phase of this subject is the attitude of the public and the necessity of careful planning before the inauguration of one man service. In a city that has become accustomed to street cars manned by two men, the advancement of the one man car idea is apt to be received by the public at first with intense hostility. This is perfectly natural: first, because of the habit of seeing two men on cars, second, on account of the sympathy of the public with the men displaced by one-man operation." Mr. Cass, however, states that if the necessary precautions are taken and preparations made and "the foundation for one-man service built with a frank, open statement concerning its necessity, there should be no difficulties in obtaining in advance the sanction of a fair proportion of street-car riders, and when the system has been installed and is working smoothly, you will find that the travelling public will be entirely satisfied."



Safety car for Puget Sound, one-man operation.

Improved Service

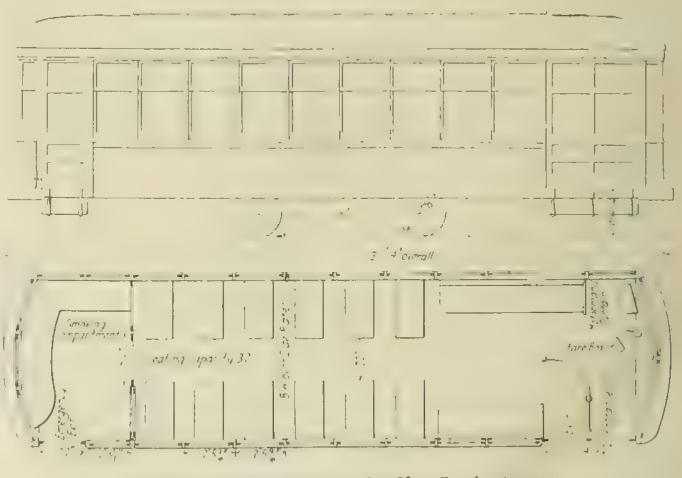
The best argument in which to interest the public seems to be that the new type of car enables the operating company to give a more frequent service. This naturally also means a less crowded and more comfortable service—all of which appeals strongly to the average street-car patron. Experience seems to show that this is the way it works out in many cases. For example, Mr. C. H. Beck, of the Westinghouse Traction Brake Company, speaking before the Illinois convention regarding the operation of one-man cars in the city of Fort Worth, Texas, states that, "the service previously given on this line was 15-minute headway in non-rush hours and 7½ minutes in rush hours, the original type of car being a double-truck, double-end car, having a seating capacity of forty passengers. The physical characteristics of the line made it a most difficult problem to try out experiments, for the reason that it is single track construction with a large number of switches and curves and practically no level track. With the original service the average schedule speed was 8.8 miles per hour and the average number of passengers handled, 3,860. With the "Safety" cars a non-rush hour service of 10-minute headway and a rush hour service of 5-minute headway was installed, thus increasing car service 50 per cent. At the same time the average schedule speed of 9.9 miles per hour was established, an increase of 12.7 per cent. The number of passengers for the first 15 days of operation averaged 4,510, an increase of 16.8 per cent.

With the increase in car mileage of approximately 50 per cent., the receipts per car mile naturally decreased. However, it was found that whereas the old cars were operated on a basis of 2.4 kw.h. per car mile, the new cars are being operated on a basis of 1 kw.h. per car mile, with prospects of slightly reducing the cost of operation of the new cars after the men become familiar with the operating conditions. Regarding the whole question of power consumption, it was found that, with a service amounting to fifty per cent. increase in car miles per day, the consumption in total kilowatt-hours was actually 25 per cent. less."

Another interesting point was brought out by Mr. Beck, showing advantages resulting from more frequent service. In the particular system which he describes the fact developed that the north-bound traffic (toward the centre of the city) was only 85 per cent. of the out-bound traffic. This indicated a considerable possibility that a number of patrons were being carried towards the city by other means of conveyance, probably by their friends who owned automobiles. Since the advent of the more frequent service, however, this ratio has increased until it is merely equal as between the north-bound and the south-bound traffic. This means that the prospective passenger is now satisfied to wait for the shorter time required under the new schedule when he formerly walked or hailed a friend under the less frequent schedule.

Collection of Fare

The consensus of opinion regarding the best method of collecting the fares is that they should be taken as the passenger enters. There are occasional instances of collection as the passenger leaves the car, but apparently this method is not popular. Where the entrance vestibule is large many companies allow the conductors to close the door and start the car before collecting the fares; this naturally improves the schedule but local conditions would determine whether or not this practice is desirable. Transfers, in the majority of cases, are handed out as the passenger leaves the car.



Single End, Two Compartment, One-Man Car for Quincy

Car Details

Local conditions must also regulate the size and weight of the cars. The average length is around 30 feet, and the average seating capacity around 35. The weight of a certain type of this car has been brought as low as 10,000 lbs., but unless the roadbed is unusually good, this would appear to be sacrificing engineering efficiency to operating economies. The dimensions and equipment of the lightest cars used in the United States, which are taken from a recent issue of the Electric Railway Journal, are given in Table I. Plans of different types of car are shown in Figs. 1 and 2. It will be noted that in each of these, the entrance door is at the operator's right hand; also there is an emergency door at the rear.

Cars Are a Success

From data obtained from different sources, there can be little doubt but that the new type of car is a success when intelligently operated under favorable conditions. Their use in Canada is already very considerable, and below we are able to reproduce the opinions of four or five well-known Canadian electric railway men regarding the operation of one-man cars on the system with which they are associated. We have yet to hear of the case of a one-man car being discarded after a fair trial. The following opinions from various provinces of the Dominion are of very practical interest. In Saskatchewan this type of car is barred by the Provincial Railway Act.

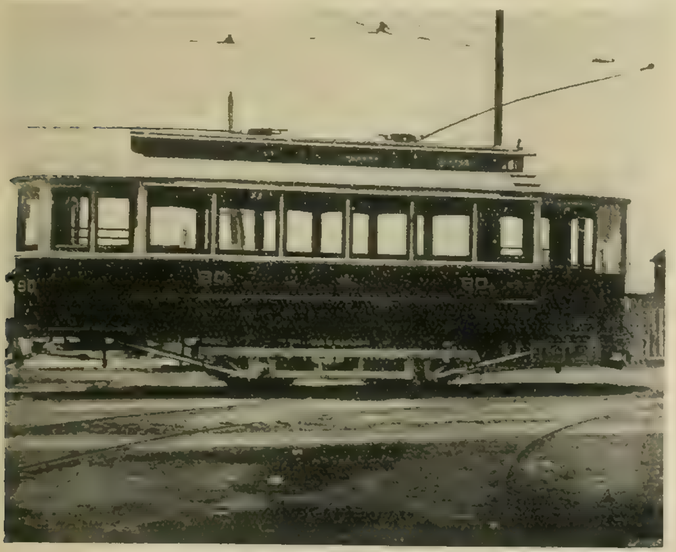
Reconstruction of an Old Style Car into a Modern One-man "Safety Car"

By H. E. Weymore*

The Levis County Railway Company has recently put into service two one-man cars and they have proved a considerable success, see Figs. 3 and 4.

This company operates opposite Quebec along the banks of the St. Lawrence River, and has to operate in conjunction with the Ferry Company, the service being 15 minutes and in winter half an hour, the result being a congestion at certain hours. There are 18 miles of track feeding three districts, all single track with turn-outs, stub end and double end operation, which is a great disadvantage and expensive.

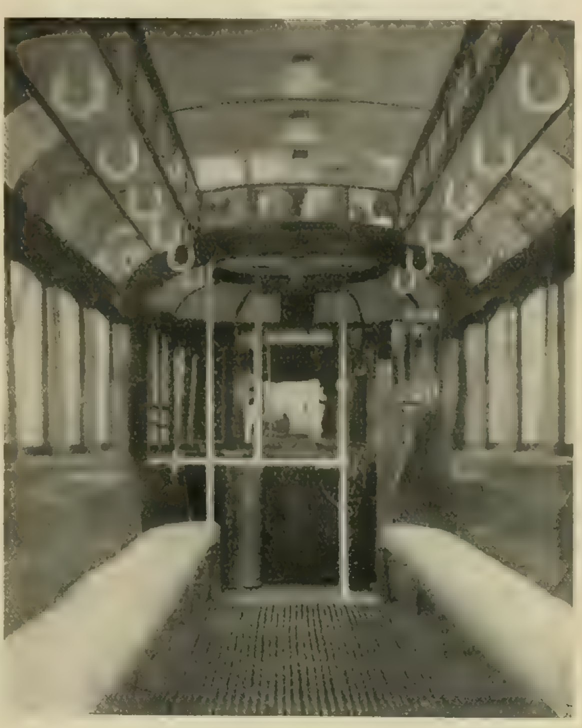
Since the cars have been put into service they have proved that they can handle the traffic, maintain the service and time without any trouble, and have found a good deal of favor with the public, besides inducing more people to ride owing to the neat, sanitary and pleasing appearance. The car is of the one-man "Safety" type, p.a.y.e., which has found so much favor in the United States, and it has been found that fares are not missed as was the case on the other cars.



Reconstructed car with door step closed, Levis, Que.

The car was reconstructed from the old type of box car, single truck, with concave sides, some 15 years old. It was found that the old wood vestibule braces and cross beams which carry the total weight of body, would have to be removed. It was decided to design and build a steel underframe which would fit under and around the old wood members, enclosing them as it were, the only wood members removed being the platform braces and buffer beam.

In the reconstruction the car was made 2 ft. 6 in. longer by lengthening the vestibules at each end. The bulkheads and doors were removed and an arch built in. The vestibules were closed in on the left hand side and a seat for two persons was installed. On the right hand side, double two-leaf folding doors, with folding steps working automatically together, was installed, manually operated, the handle being next to controller.



Interior view reconstructed car, Levis, Que.

Folding seats were also installed on the door side, which fold up behind door when not in use.

The operator is protected from the passengers by railings which also carry the fare box, and curtain to protect the operator at night from the light.

The seats are of rattan, with angle iron seat frame, and open to full view underneath for sanitation and heating purposes. Special attention has been paid to the sanitary condition of the car. All old wood groved moulding work has been removed and replaced by plain molding. Rico sanitary strap hangers have been installed.

The lighting has been changed from the old cluster system to Safety Car Lighting fixtures and reflectors placed down the centre of the car, with a light in each vestiblue and Golden Glow head lights.

Push buttons and buzzers, and shaftless brakes, are installed. The interior finish is mahogany with cream enamelled ceilings, a new departure which gives a surprisingly pleasing and sanitary effect.

The car being used for double end operation, two trolley bases and poles were installed, with retrievers.

The work was carried out under the direction of the writer, master mechanic, A. K. MacCarthy being general manager.

Sherbrooke Railway & Power Company

By F. K. Couture*

We have been operating, during the past four years, seven one-man cars, and have found this system of operation a success in every way.

It has reduced the cost of operation considerably and enables us to give our conductor-motorman a higher rate of pay and thereby saves us considerable trouble in the procuring and retaining of men.

---

*Master Mechanic.

*Railway Superintendent.

Of course, we do not use this system on our Lennoxville line, which has very heavy traffic, as we feel that it would not be very successful where the travel is so heavy as considerable time would be lost in the collection and sale of tickets.

Moncton Tramways, Electricity and Gas Co., Limited

By A. B. Coryell*

The Moncton Tramway, Electricity and Gas Company, Limited, began the use of one-man operated cars December 1st, 1916, having remodeled their cars used by two men, installing Colman No. 4 Fare Boxes, installed so that the motorman can take them from one end of the car to the other, the car being operated from both ends, there being no loops at either end of the lines. We also installed National Fare Registers to be used in connection with the fare boxes.

We closed up one side of each vestibule, taking off the step on that side, and on the opposite side we installed double folding doors which we can lock. These doors are closed and locked on the rear end in which ever direction the cars are run. When the car reaches the end of the line, or terminal, the motorman turns his trolley, carries his fare box to the other end of the car, locks the rear door, and is off. The car stops on the near side of the street, the passengers dropping their fare in the box as they enter the car.

This arrangement has worked out to the satisfaction of both the company and the public. The travelling public seems to like this new arrangement better than with the two-man car. We installed push buttons and bells in all the cars, so the passengers have only to push the button when they wish to get off. When we inaugurated this system we increased the wages of the one man 25c per day. With this new system, it has made the railway which was a non-paying one with the two-man cars, into a paying one. We operate four cars.

*Superintendent and Purchasing Agent.

The Three Rivers Traction Company

By W. S. Hart*

"Our road has been in operation since December 13th, 1915, and we have operated continuously since that time only "one-man" cars, and have found that they have served the district of Three Rivers very satisfactorily. In fact we could not have used 'two-man' cars in that district as the traffic does not require it and the expense of the extra man would be prohibitive.

There is a noticeable decrease in the number of accidents to passengers when carried on the "one-man" car over that carried on the ordinary "two-man" car.

Service in a small locality is more or less on the stage coach plan. The cars should be light and seat from thirty to thirty-five people, and the service frequent. We have been able to maintain a frequent service and have consequently induced more travelling than as if the service had been less frequent. On the whole we have been very pleased with the operation of our cars.

We would suggest that you bring up for consideration a change from the name of "one-man" car to "safety car" or "light safety car." We think the name more suitable for the kind of service, and also that it will remove prejudice which may exist or may be easily fostered when a "one-man" car is talked about in a community where it has never been tried out.

*Secretary-Treasurer.

Edmonton, Alta.

By J. H. Moir*

Up to the present time we have only operated two one-man cars throughout the city, that is on stub lines where the traffic is not so heavy. As far as the safety and convenience of passengers is concerned, we consider that the one-man method in this particular respect has proven successful.

Several cars are being prepared in our work shop, to be operated as one-man cars on some of our lines, through the centre of the city, when they are ready. I cannot give you much information as to the one-man project in this city as yet, but I have seen them operated in other cities with good success. We believe that we will be operating additional one-man cars in August of this year.

*Superintendent.

Lethbridge, Alta.

By M. Freeman*

In reply to your letter of the 29th of May, asking for information re "one-man" cars, our population is approximately 11,000. We operate five cars on schedules of 12 to 15 and 30 minutes, respectively. We have now operated our cars on the "one-man" system for over two years, and the results have been most satisfactory, both as regards the public and city.

Under this system we have practically eliminated accidents. It is possible to make better time and the system is more efficient in every way. Ours is a very small system, but even when the cars are crowded we experience no trouble. Some larger cities are inclined to think that the one-man system would not work out as satisfactorily with them as with us, but we believe this to be all imagination. It is a difficult system to introduce on account of the strong opposition from the labor end, and in some cases municipal politics.

In introducing this system the cars have to be altered according to the style of car to give room for exit and entrance at one end, also for the motorman. This was accomplished in our case by reversing our cars, putting in two doors in the front end, and other slight changes. The direct economy is in the time of one man per car. Indirectly we have saved considerable due to the elimination of accidents.

*Utilities Commissioner.

The Problem of the Electric Railway Fare

In spite of the fact that practically every commodity purchased by the public has increased very considerably in price during the past ten years, and more especially since the outbreak of war, the cost of electric railway fares remains the same. The situation has now become acute in many cases, however, primarily because the increased cost of operation—wages, supplies, etc.—has more than offset any possible economies due to mechanical improvements or more efficient organization, and latterly on account of conditions brought by the war, both in the form of reduced revenue, following depleted populations, and also due to the abnormal price of every kind of material. The competition of the jitney, which in many towns and cities has been allowed to operate under conditions absolutely unfair to the street railway systems, has also had its part in cutting down the revenues of the latter.

As a result of these conditions street railway systems are finding it increasingly difficult to earn bare dividends—indeed, in a number of cases are barely meeting expenses—and it is becoming increasingly evident that the time-honored 5-cent ride is due for a rise in price. No other solution is advanced, and no other seems possible—it is a choice between a higher fare or a receivership—and (even if no one had to be considered but the public) it is plain that the latter alternative would work infinitely the greater hardship.

Discussions that have been going on for many months have at last taken definite form in a number of sections of the United States, and more particularly in New York City. Informal conferences have recently been held between a special committee of the New York Electric Railway Association and the Public Service Commissions of the First and Second Districts to explain to the commissions the urgent need for higher fares. As a result of these conferences formal applications for relief have been made and public hearings held. The application has taken the definite form of a charge of 2 cents for transfers.

We in Canada can no longer close our eyes to the fact that similar conditions have to be met on many of our electric railway systems. Under present conditions the average ride on a street car is worth more than 5 cents, and it is as useless to endeavor to keep the price down to this amount and expect to get service as it is to expect to get any other commodity we buy at the price attached to it five or ten years ago. It is still possible, no doubt, to buy a pair of shoes for $5, the price we were accustomed to pay in the old days, but what kind of shoes are they? What kind of service do they give? And it may still be possible to force our railway systems to operate on the old 5-cent basis, but if we demand this, we can only expect 5 cents' worth of service, and this will not satisfy the average citizen to-day, who is used to good service. In the very near future Canadian municipalities must meet this question of increased fares squarely and fairly.

Annual Meeting C.E.R.A.

The annual meeting of the Canadian Electric Railway Association was held in Montreal on Tuesday and Wednesday, June 5 and 6, in the Windsor Hotel. As usual, the meetings were private, only representatives of member companies being admitted to the sessions. The president, Mr. E. P. Coleman, general manager Dominion Power and Transmission Company, presided. The election of officers for the ensuing year gave the following results:

President-elect C. L. Wilson.

President, C. L. Wilson, assistant general manager Toronto and York Radial Railway, Toronto; vice-president, A. Eastman, vice-president and general manager Windsor, Essex and Lake Shore Rapid Railway, Kingsville, Ont.; honorary secretary-treasurer, Mr. Acton Burrows, Toronto; executive committee: J. D. Fraser, director and secretary-treasurer of the Ottawa Electric Railway, Ottawa; A. Gaboury, superintendent Montreal Tramways, Montreal; E. P. Coleman, general manager Dominion Power and Transmission Company, Hamilton; G. Gordon Gale, vice-president and manager Hull Electric Railway, Hull; J. S. Mackenzie, purchasing agent Winnipeg Electric Railway, Winnipeg; H. G. Matthews, general manager Quebec Railway, Light, Heat and Power Company, Quebec; E. L. Milliken, manager Cape Breton Electric Railway, Sydney, C.B.

On Tuesday evening the delegates were the guests at a dinner given by the Montreal Tramways Company, when Lieut.-Col. Hutchison presided. The other speakers included A. P. Coleman, James Anderson, manager of the Sandwich, Windsor, and Amherstburg Railway, Windsor; Patrick Dubee, secretary-treasurer of the Montreal Tramways; A. Gaboury, superintendent, and W. G. Graves, chief engineer of the same company; Chief Tremblay, of the Fire Department, and Mr. George Ham. On Wednesday Col. Hutchison entertained the officers and executive committee, and Sir Alexander Bertram, to lunch at the St. James Club; and in the afternoon, with Col. Hutchison, these members, in the official car of the Montreal Tramways Company, visited some of the principal properties of the company, including the powerhouse at Hochelaga, which is being extended, and the car barns at Youville.

With a view to the prevention of accidents, the Montreal Tramways Company are adopting a device which will do away with riding on the steps of the cars. Each car is to be equipped with an outer door, the opening and closing of which is operated by air, under the control of the conductor. When the conductor is of opinion that there are sufficient passengers he closes the door by bringing the device into operation, which at the same time raises the steps. A system of electric light signals, automatic in their working, intimates to the motorman when the door is open or closed.

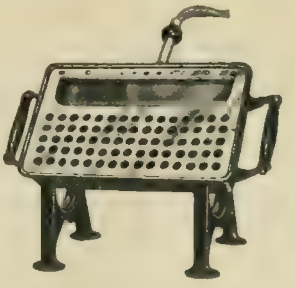
The Montreal Tramways Company have increased the wages of the motormen and conductors by 2 cents per hour, from the 1st of July. The scale will then be 25c an hour for the first two years, 26c for the next two years, and after five years' service 29c.

A delegation from Bradford and Cookstown, Ont., recently interviewed the Hydro-Electric Power Commission of Ontario relative to securing a supply of light and power for the southern portion of Simcoe County.

The April earnings of the Winnipeg Electric Railway, just announced, are: Gross earnings, $265,594; net after operation, $71,414; net after charges, $10,166.

Electric Radiator

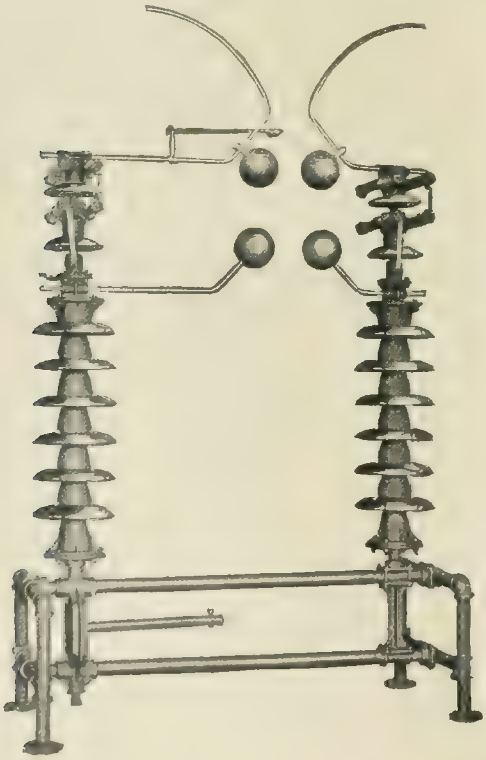
An electric radiator designed for use in bathrooms and other places of small dimensions is shown in the accompanying illustration. It is intended to be used on either table or floor, and has handles provided for lifting. The size of the radiator is 7 in. by 11 in., and it is rated at 500 watts. The device is offered to the trade by the Pelouze Manufacturing Company.



What is New in Electrical Equipment

Sphere-Gap Electrolytic Arresters

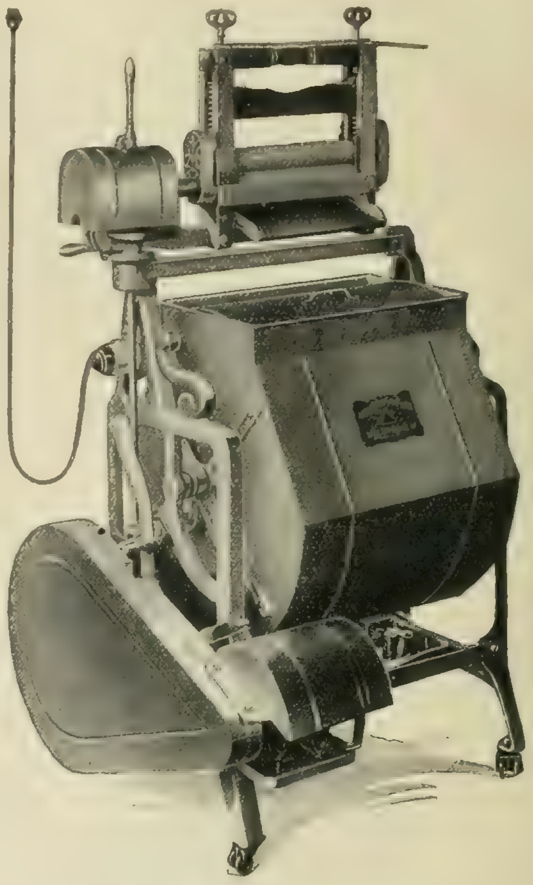
Sphere gaps are now available on all aluminium-cell electrolytic lighting arresters made by the Canadian General Electric Company for service above 7,250 volts. For lower voltages the diameter of the copper rod used to form the horn gap is so large in proportion to the gap that the effect is the same. The upper set of spheres have horn extensions, to assist the arc to rise and thereby extinguish it quickly. Horns are not necessary on the lower spheres, as the arc rises from them to the upper ones and is thus extinguished. The sphere gap discharges faster for sudden impulses than the horn gap, and has a shorter dielectric spark lag. These characteristics are necessary for protection against the sudden impulses of electrical disturbances, the manufacturer points out. Protective gaps should be as "fast" as possible, and the insulation of the other apparatus as "slow" as possible, because a definite time is required to flash over or rupture all insulations, such as air gaps, surface and solid dielectrics. The time interval varies with the nature of the insulation, the shape and spacing of the surfaces or electrodes, and the frequency and magnitude of the applied voltage. Differences in the dielectric spark lag, although almost infinitesimal, are appreciable when the rate at which the abnormal voltages can be applied is of the order obtained with lightning or similar disturbances. Because of this phenomenon attending dielectric spark lag, a voltage wave in the form of a sudden impulse may not break down what is apparently the easiest path. For example, the voltage may rise beyond the 60-cycle discharge voltage of the protective gaps and arc over or puncture insulation having a much higher 60-cycle discharge test voltage.



The bondholders of the Ontario West Shore Railway Company have been granted permission by the Ontario Railway Board to dispose of their assets, valued at about $120,000, to the Ontario Hydro-Electric Commission.

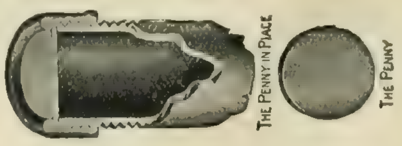
New Apex Electric Washers

The new electric washers manufactured by the Apex Appliance Company, Chicago, operate on the oscillating tub principle. The tub is all metal, made in a generally triangular form, with a peak or "apex" at the bottom. On the sides, horizontally, are attached "V" shape strips, as well as on the "apex" at the bottom. These act as shoulders to give a positive throw to the contents when the tub is oscillated. The outfits are belt-driven by Robbins & Myers special washing machine motors of 1/8, 1/6 and 1/4 horse-power capacity, depending upon the size of the washers.



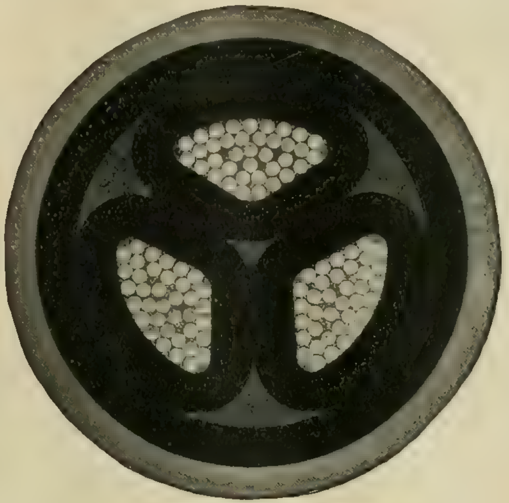
The T & B Penny

The T & B Penny is a device for closing the ends of conduit systems during construction, to keep out dirt, plaster, concrete, etc. It is claimed to be superior to the old style wood plug which it replaces. It is placed inside the conduit bushing, which is screwed on the threaded conduit end, effectively closing the opening. Nothing can drop, or be forced into, the conduit. Being under the shoulder of the bushing, there is nothing to knock off. The device is made in sizes, 1/2 to 3 inch, inclusive, and is sold by the Northern Electric Company, Ltd.



Toronto Hydro Electric

orders another eight miles of



PHILLIPS CABLE

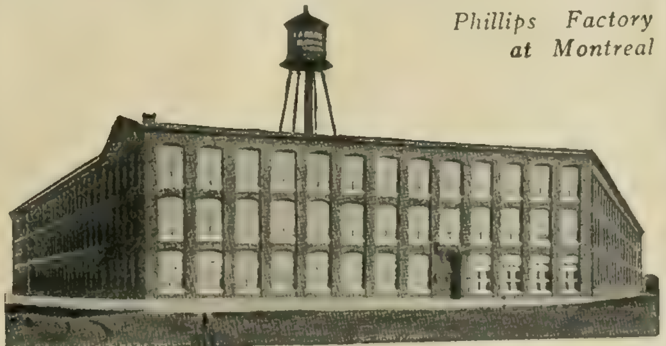
Here is strong endorsement of the quality and serviceability of Phillips heavy duty cable. The Toronto Hydro Electric System recently sent us a repeat order for the supply and installation of 8 miles of 250,000 C.M., 3-core, 13,200 v. cable, illustrated above. After installing miles of our product and giving it a most thorough testing in actual use, this re-order is conclusive evidence of the opinion of "T.H.E." experts. Phillips Cable will give you the best of service for power, telephone, lighting, railway or special use.

Write us for further details.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

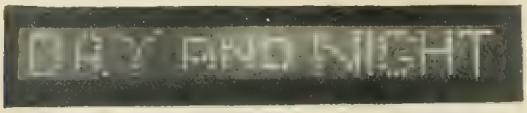
Branches: Toronto Winnipeg Regina Calgary Vancouver



Phillips Factory at Montreal

The "Travel Flash"

In a recent issue of the Electrical News we described the electrograph, an apparatus for communicating any desired message to a crowd of people inside of buildings or in the open air. This is done by means of electric flashes on a field or bank of electric lamps, certain groups of lamps being lighted momentarily to form the letters of a word or words which in succession arė visible and form the desired sentence. This very successful advertising medium is manufactured by the Electrograph Company, of Chicago. Since the publication of our former article this same company has produced a new type of electric talking lamp, which is different from the first, in that instead of consecutive flashes which remain steady for short periods and follow one another, in the new system the text or flashes are moving constantly across the lamp bank. It thus tells a continued, connected story of any length as fast as the eye can read. This improved system, known as the "Travel Flash," in which the words are traveling across the lamp bank continuously from right to left, is most suitable for general publicity for municipalities, central stations, real estate firms, and others who may wish to reach a large number of people continuously with their message.



The Wagner Electric Manufacturing Company, of St Louis, announces the appointment of Mr. F. T. Coup, formerly connected with its Chicago office, to take charge of its Milwaukee office, in its new location, the First National Bank Building.

Personal

Mr. W. G. Murrin, formerly general superintendent, has been appointed assistant general manager of the British Columbia Electric Railway Company.

Mr. T. J. Lawrence is now in charge of the Toronto office of Jones & Glassco, at 256 Confederation Life Building, succeeding Mr. G. A. Kingstone, who resigned to take up military duties some time ago.

Lieut.-Col. C. H. Mitchell, D.S.O., C.M.G., M.Can.Soc.C. E., of the firm of C. H. & P. H. Mitchell, consulting engineers, Toronto, was among those upon whom honors were conferred on the occasion of the King's birthday.

Mr. A. Longstaff, for seven years superintendent of the municipal electric plant at Cardston, Alta., has resigned to take over the management of the electric light department at Pincher Creek, succeeding Mr. F. Rhodes, who has enlisted in the air service.

Lieut. J. A. Gordon White, formerly with the Mond Nickel Company, Victoria Mines, and later in the hydraulic department of the Hydro-Electric Power Commission of Ontario, has been awarded the Military Cross. He is a graduate of McGill, 1911, applied science.

Mr. Lawford Grant.

Mr. Lawford Grant has been appointed managing director and treasurer of the Eugene F. Phillips Electrical Works, Ltd., Montreal, Que. Mr. Grant came to Canada in 1907 as president and managing director of the Canadian British Insulated Company, with the parent company of which—the British Insulated and Helsby Cables—he had been employed since 1901, for four years as superintending engineer in England and for the last two years as managing engineer and agent in Malta. In 1907 he resigned from the Canadian British Insulated Company to become assistant manager of the Eugene F. Phillips Electrical Works, which position he has held up to the present time. Mr. Grant is a member of the Institution of Electrical Engineers and of the American Institute of Electrical Engineers.

Trade Publications

Church Lighting—An attractive little booklet, well illustrated, entitled "The Influence of Lighting on Church Attendance." Published by National X-Ray Reflector Company.

C. G. E. Publications — Bulletin No. 48609, Centrifugal Compressors; Bulletin No. 47011, Direct Current Switchboards; Bulletin No. 46112, Deflection Potentiometer; Bulletin No. 48304, Hand-Operated Starting Compensators for Squirrel Cage Induction Motors; Bulletin 46501-A, G. E. Flow Meters for Measuring Steam, Water, Air and Gas; leaflets, Small Battery Charging Outfits and AC to DC Compensarcs.

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Power without Authority

One of the most useful activities of the Advisory Council on Industrial Research has been the investigation that has been going on for some months on the possibility of utilizing the immense lignite deposits of central western Canada for heat and power purposes in place of imported coal. It appears, however, that the Dominion Government is loath to act upon the recommendation of the Council where it involves the expenditure of any considerable sums of money. For example, in a recent address before the Canadian Manufacturers' Association in Winnipeg, H. N. Ruttan, one of the members of the Advisory Council, first raised the hopes of his hearers by announcing that lignite in the form of briquettes could now be marketed at two-thirds the cost of the heat equivalent in hard coal, only to add that the government was not prepared to spend the comparatively small sum of $400,000 in establishing a plant which would have a capacity of 200 tons a day. Fortunately the manufacturers placed a different value on expediency and offered to raise the sum required within twenty-four hours, if it were not forthcoming elsewhere.

This incident illustrates at the same time the potentiality and the impotence of such a body as the Advisory Council. Recommendations are quite useless unless they are acted upon, and, surely, at a time like the present, when the coal problem is one of our biggest and most urgent, the government need not delay over the expenditure of less than half a million dollars. Expediency demands that the decision to withhold this sum be reconsidered and plans prepared for establishing a plant without a moment's delay.

In this same connection it is reassuring to note the action being taken in one of our sister colonies, Australia, where favorable reports have also been made on the utilization of lignite for power purposes. The following is from a recent issue of the United States Commerce Reports:

The Institute of Victorian Industries has approved the utilization of lignite as a source of power. In its report favoring the project the institute's brown-coal sectional committee presented the following data and recommendations:

> **Brown-coal uses.**—(1) To supply electrical power to Melbourne and other parts of the State; (2) briquet making for household and other requirements; (3) producer gas; town gas; tar and its derivatives, ammonia, and coke.
>
> **Power production.**—The Melbourne city council and Melbourne Electric Supply Company can at present supply a maximum of 28,000 horse power. Requirement in 1925, estimated from normal increase, 120,000 horse power. This estimate is for Melbourne alone, and does not allow for new industries made possible by cheap power. Electrolytic treatment of zinc concentrates may absorb 200,000 horse power.
>
> **Costs.**—Newcastle slack coal costs 20s. ($4.85) per ton. Estimated cost of Morwell coal, 2s. 3d. ($0.55) per ton at mine. Morwell coal, with 40 per cent. moisture, has 0.416 the heat value of Newcastle coal. Electrical energy produced at Morwell by 5s. 5d. ($1.30) worth of brown coal equals amount produced in Melbourne from 20s. ($4.80) worth of Newcastle coal and can be transmitted to town at about half the fuel cost of the latter. Victoria pays 10s. ($2.40) more per ton for black coal than New South Wales. The electrical power scheme will remove this handicap.
>
> **Briqueting.**—Morwell briquets need no binder and can be produced for 11s. to 13s. ($2.70 to $3.15) per ton. They can be sold to householders in Melbourne and suburbs at about 24s. ($5.85) per ton, as against 24s. 6d. ($5.95) for wood, 32s. 6d. ($7.90) for coke, and 35s. ($8.50) for black coal. Estimated cost of single-press plant, £15,000 to £20,000 (roughly $75,000 to $100,000).
>
> **Recommendations.**—Recommended that immediate State action be taken (1) to confirm estimates in regard to public power requirements and the best means of satisfying these; (2) to decide what authority shall do the work and when; (3) to obtain estimates of the cost of (a) 50,000 kilowatt plant at Morwell and of similar plant at Altona, with transmission line, etc., in each case; (b) opening up and equipping a quarry at Morwell to supply a 50,000-kilowatt plant and 120 tons of briquets a day; (c) briqueting plant, one press, capacity 60 tons daily; (4) that two experts should be sent abroad immediately to investigate latest power-plant practice and equipment necessary to secure full utilization of our vast brown-coal resources.

Dependance on Electric Power

Mr. H. E. Howe, of Arthur D. Little, Ltd., was the speaker at the Montreal electrical luncheon on June 13—the last of the season. His subject was "The Relation of Electrical Products to Other Industries." After commenting on the dependence of industries upon each other, Mr. Howe dealt with the relation of electrical products to food, clothing, general manufactures, transportation, construction, communication, and farming. As to food, they all knew the advantages of the electric oven, although he believed that the cost would have to be reduced before these appliances came into more general use. The hydrogenation of oils had been the means of rendering many oils suitable for different grades of soap, while there was also a long list of fats which had been turned to greater account owing to the employment of processes connected with electricity. The combination of electricity and chemistry in the production of chlorine had been of immense benefit in the bleaching of clothes, and the wide use of artificial silks depended upon a product of the electric furnace.

Under the heading of manufactures, Mr. Howe referred to electrodes manufactured from artificial graphite, artificial abrasives supplied from electric furnaces, the cheapening and production of phosphorous, the production of aluminium due to cheap power, chlorine in relation to dyes, tool steels which could not be produced so extensively without electric furnaces, and so on through a long list of commodities.

With regard to transportation, he enumerated the advantages resulting from the application of electricity to railways, tramways, ferry boats, etc., incidentally touching on the question of regenerating braking. The field of construction offered a great opportunity for electrical appliances, such as hoists; and, as to communication, they all appreciated how much the world was dependent upon telegraphs, telephones, wireless, etc. Mr. Howe concluded with a brief history of the fixation of atmospheric nitrogen, and said there was every reason to believe that we should eventually be independent of nitrates for agricultural purposes.

At the conclusion of the address Mr. Chennell, the secretary, presented a report on the past season's luncheons, which have been very successful from the attendance point of view and also as regards the excellent character and variety of the papers read. The average attendance increased from 48 in the 1916 season to 63 in 1917. Visitors from all parts of Canada, also from over the line, had attended in considerable numbers, and the example of Montreal in instituting the luncheons had been followed by Toronto. The sum of $121 had been collected for the Patriotic Fund.

On the motion of Mr. E. N. Hyde, seconded by C. Thomson, it was decided to ask the committee to consider the question of forming a permanent organization and to report in October.

Votes of thanks were passed to Mr. W. H. Winter, the chairman; Mr. P. T. Davies, the chairman of the papers subcommittee, and to Mr. Chennell.

Electric Farming in Fraser Valley

The farmers and ranchers of the famous Fraser Valley are probably as up to date in their methods as any of their class in the older settled districts of Canada, not excepting those in Niagara Peninsula, whose lands abut on the hydro-electric power lines, and who are thereby enabled to apply the Jovian maxim, "Do it electrically," when carrying out most of their farming operations. Quite recently a number of ranchers to the south of Chilliwack clubbed together and raised $5,000 for the construction of a power line from the town's electric plant to their premises, over two and a half miles of wire being strung, the idea being to use electric power generated by the British Columbia Electric Railway for a variety of purposes hitherto dependent on man-power. The total investment represented in line construction, power installation, and motors was in excess of $5,000. The step taken may be attributed to the good work of Chief Electrician Porter, of the B. C. E. R. Company, Vancouver, who for the past couple of years has been demonstrating how the farmers of the Fraser Valley might lessen the hard work of husbandry by taking advantage of the company's far-flung electric system. Many at points closer to Vancouver have already done so, and now the farmers of Chilliwack district, eighty miles away, are coming into line.

Electric Company's Large Subscriptions

"Liberty Loan Day" at the various plants of the General Electric Company resulted in the sale of nearly $3,000,000 worth of liberty bonds. The Schenectady works, with 22,000 employees, the largest plant and the company main office, leads with the surprising total of $1,055,700. The Lynn, Mass., plant is second, with $577,450. The totals for the company's various plants at 4 p.m., June 12, are as follows:

Schenectady works, including gen. offices	13,223	$1,055,700
Lynn works	8,598	577,450
Pittsfield works	4,037	282,550
Erie works	2,445	176,900
Edison Lamp Works	3,175	211,900
Fort Wayne works	2,125	151,550
Sprague works	802	57,550
National Lamp Works	3,910	253,600
District sales offices	1,685	208,350
	40,000	$2,955,550

The company had previously announced the purchase of $5,000,000 of the liberty loan bonds, and that it would buy bonds to any amount its employees would subscribe and allow them to pay for them on a liberal installment plant. A large number took advantage of this plan to buy bonds. In a number of departments every employee subscribed for a bond. The sale among workmen of foreign extraction was truly astonishing, particularly among the Italian and Polish employees.

The Value of Electricity Supply in War Time

It is safe to say that there is to-day no class of industry, no kind of manufacturing enterprise, which is not dependent upon electric central stations for power or light, or both. Within the last two years the expansion of factories and mills engaged in the production of munitions for war and the various materials used for their manufacture has resulted in greatly increased use of central station electric power.

Light for our streets and homes provides the most effective protection and security against all forms of disorder and crime which the unsettled conditions may encourage.

In order to maintain our service with undiminished effectiveness it is, of course, necessary that the public utilities should retain at least the greater part of their forces of skilled men, and prompt measures must be taken to offset the effect of enlistment and the application of the selective draft in decimating our organizations. We must find ways and means of holding the bulk of our men in their present jobs without discouraging enlistment or in any way embarrassing the government in raising the required military forces.

It is most desirable for us also to consider what position we are to take in contributing toward the support of those dependent upon our employees who enlist or who are drafted. Undoubtedly our inclination is to be liberal in our contributions, but, on the other hand, the limitations of our financial resources, particularly in view of the great increase in the cost of fuel and supplies and the possibility of curtailed earnings, must warn us to pause before taking precipitate action which we may afterward be forced to modify.

One of the most serious problems which confront us is the scarcity of fuel, or the means to assure its delivery in such regular quantities as our requirements demand. Some prompt and well-organized action must be taken to bring before the proper government authorities the extreme urgency of the adoption of measures to put public utilities in a preferred class for fuel supply.

Without doubt our central station companies will be called upon for increased service for many industrial purposes in connection with government contracts for munitions and supplies, and this possibly without a proportionately diminished demand for the usual commercial and domestic service. With the slow deliveries of equipment and apparatus for extensions, and the possibility that available supplies may be commandeered by the government, we are faced with the possibility of increased demand upon our output beyond our capacities to supply.—Retiring President Wagner at N.E. L. A. convention.

Meeting of Electrical Council of Underwriters' Laboratories

A business meeting of the newly organized electrical council of the Underwriters' Laboratories was held at the testing station, Chicago, on Wednesday and Thursday, May 23 and 24. Among the members present were Mr. H. F. Strickland, chief inspector Hydro-electric Power Commission of Ontario, and Mr. F. A. Cambridge, city electrician, Winnipeg. The meeting was of special interest in that it was the first business session of the council. A lively interest was manifested in the scope of the council's work and the method of procedure. A considerable volume of routine business was disposed of, among others being an extension to the existing standards on metal moulding, so as to include surface metal raceways in one piece design for use on two-wire circuits not exceeding 1320 watts capacity; under this extension the new surface wiring raceway known by the trade name of "Wiremold," was listed standard.

Staff engineers were ordered to undertake an investigation on the subject of fuses and report to the council at a future meeting regarding possible specifications, method of testing, supervision and field of follow-up of the details of design, construction and performance under test of refillable fuses.

A resolution was adopted asking the attention of manufacturers to the desirability of paying more attention to accident prevention features in the design and construction of their various appliances.

The newly developed standard on armored cables was formally adopted and the following items discussed at considerable length:—Construction and use of miniature motion-picture machines, electrical heaters and pressing irons, ground clamps, bell-ringing transformers and disconnecting plugs or receptacles of large capacity for battery circuits and similar uses.

Prominent United States Electrical Men Doing War Work

Some months ago the Committee of the American Gas Institute, to co-operate with the Government in regard to the military needs of the Nation and the Committee of the National Electric Light Association on war conditions, at a joint conference held in New York city, decided to organize a National Committee which would secure to the United States Government the most effective co-operation in the conduct of the war from the gas and electric light and power industries. The National Committee on Gas and Electric Service was thereupon organized with a membership of representative men from these two industries and the related natural gas industry, and includes such well-known electrical names as Philip P. Barton, vice-president, Niagara Falls Power Company; Alex Dow, president Detroit Edison Company; Charles L. Edgar, president Edison Electric Illuminating Co. of Boston; Samuel Insull, president Commonwealth Edison Company; D. C. Jackson, Prof. of Electrical Engineering, Massachusetts Institute of Technology; Joseph B. McCall, president the Philadelphia Electric Company; and John W. Lieb, vice-president the New York Edison Company (chairman of committee).

This committee is recognized by the Advisory Commission of the Council of National Defense as one of its advisory committees, and it has established an official headquarters in the Munsey Building, Washington, D.C., where it has placed itself at the service of the Government for any assistance it may be able to render in behalf of the public utility industries it represents. It is prepared to act as a vehicle of communication between the various instrumentalities organized by the Government for the conduct of the war and the gas companies producing and distributing artificial and natural gas and the electric light and power companies furnishing electric service, in all matters relating to the National Defense. It proposes to promptly place at the disposal of the Government any data or information which it may require as to the facilities in men or service which they may have available, ensure the continuous operation of their plants so as to enable the munition plants, navy yards and manufacturing establishments, through continuous and uninterrupted service, to maintain their maximum output, and it will endeavor to provide the Government with the necessary quantity of the essential by-products they can make available for the production of high explosives and of ammunition.

The Importance of Fuel

One of the most essential requirements in the co-ordination of the industrial resources of the country for the successful conduct of the war is to provide a regular and adequate supply of fuel to the important utilities engaged in enterprises through which they render service to the Government and to the public. To facilitate solving the many problems affecting the continuous supply of fuel to operate their plants, the National Coal Board has been pleased to appoint Mr. George W. Elliott, Secretary of the Committee, to membership on the Coal Committee. A questionnaire is now being prepared which will, within the next few days, be forwarded to every gas and electric light and power company in the country, asking them to send a statement of the various kinds and quantities of fuel each uses per annum for its various purposes, the water or rail connections over which they are received, together with a monthly statement of fuel contracted for, received and consumed. This will enable the commitee to give prompt information to the authorities of fuel shortage in any particular locality, with the transportation lines involved, loading and unloading delays, car shortages, routing and trans-shipment difficulties, etc.

The committee has been in consultation with the authorities on matters affecting the service which the employees of the company may render to the Government in regard to various questions connected with selective registration, conscription exemptions and provision for the dependents of employees who may be called upon to render military service. The furnishing of heat, light and power service to the troop cantonments for the mobilization of the military forces located in different parts of the country is now being considered, and information is being collected as to how these agencies may be made available to the camps in the shortest possible time from the nearest points of supply.

It is believed that this National Committee on Gas and Electric Service can be of great assistance to the Government in these directions, and that it will cover a broad field of useful and patriotic service, bringing to bear on the successful conduct of the war, from the standpoint of efficient industrial mobilization, the vast resources of men and facilities which the utility companies of the country have at their command, and through which they are now efficiently serving the public, and which they desire to make available to the nation to the greatest practicable extent.

Churchill River and Tributaries

Churchill River flows east by north through the provinces of Saskatchewan and Manitoba and empties into Hudson Bay. For the last three or four hundred miles it approximately parallels the Nelson River, the distance apart varying from 100 to 150 miles. The Churchill has a length of approximately 1,200 miles, measured from the source of its longest tributary, the Beaver, to Hudson Bay. It comprises a long series of very [illegible] lakes, connected by short and usually rapid reaches. The low banks are thickly wooded with spruce and poplar. Some of the rapids are due to rocky barriers, while others flow over boulders and between banks of till, such as underlies much of the surrounding country. For a considerable part of its course the river appears to flow near the line of contact of the Archaean and overlying sedimentary rocks, although the topography is modified by the occurrence of prominent glacial features.

The absence of a valley, even where the channel might be eroded easily, and the presence of numerous lakes and rapids, show that the river is very new, geologically speaking.

The low water flow of the Churchill is considerably less than that of the Nelson. The Commission of Conservation report, just issued, estimates the former at 15,400 second feet during the open season (May to November), as compared with 51,000 second feet for the Nelson. The flow of the Churchill also diminishes much more rapidly as the source is approached. This is on account of the nature of the two rivers, the Nelson being fed chiefly from Lake Winnipeg, a constant reservoir, whereas the Churchill is fed by numerous tributaries along its course.

The water-powers of the Churchill, as computed by the Commission of Conservation report, which gives the available theoretical horse-power (May to November), vary from a maximum of 38,000 horse-power down. In the Province of Manitoba there are ten waterfalls listed—Granville Fall, 38,000 h.p., with a 25-ft. fall; at Indian Lake, 31,000 h.p., with an 18-ft. fall; another fall with 29,000 h.p., another with 23,000 h.p., another with 21,000, and so on. The total for these ten falls is 186,000 h.p.

In the Province of Saskatchewan 28 water-powers are listed on the main river. These vary in size from 35,000 h.p., with 25-ft. fall. Many of the falls are mere rapids, and are not recommended as possible power developments. The total horse-power available on this river in the Province of Saskatchewan is 287,000.

The largest tributary of the Churchill, which has an estimated flow (May to November) of somewhere between 4,000 and 5,000 second feet, is the Reindeer. On this tributary five rapids are listed with theoretical horse-power developments from 11,000 horse-power down. The total for the five is 32,400 horse-power.

Other tributaries of the Churchill have water-powers varying from 2,000 horse-power down. The Rapid River at one point has a vertical fall of 30 feet, which could be raised to 50, but the minimum flow is only 260 second feet. On the Beaver River, the main tributary of the Churchill, and which rises in the height of land north of Edmonton, in Alberta, there is a rapid fall of 27 feet and an estimated capacity of 2,000 horse-power. Altogether the theoretical horse-power of this river is listed at 516,600 horse-power.

B. C. E. R. Strike Settled

On June 13 the street railway employees of the British Columbia Electric Railway Company almost unanimously voted to strike, the vote taking effect immediately. The cities of Vancouver, North Vancouver and New Westminster were involved in the walk-out of some 700 employees. The men asked for an all-round increase of approximately 5 cents an hour, necessitated, they claimed, by the general increase in the cost of living. This demand was met by the company offering a graduated advance of from 5 to 15 per cent., combined with a bonus proposition. Under this arrangement, however, the bonus would in some cases amount to little over $1.00 a month and was considered unsatisfactory to the men. After eight days' strike the company has consented to agree to the demand of the employees for a [illegible] bonus of $300,000 a year in wages.

The unfair competition of the jitney in Vancouver has been one of the reasons why the company has been unable to be more liberal in the matter of wages, it being necessary to maintain the same efficient service while suffering a considerable loss in revenue. The granting of this $300,000 a year bonus is made on the distinct understanding that the transportation situation will be looked into by an expert and some endeavor made to improve the conditions which have so seriously affected the company's earnings.

Two More Units at Cedars

With a gross revenue of $6,783,839, the net revenue of the Civic Investment and Industrial Company—operating the Montreal Light, Heat, and Power and Cedars Rapids Manufacturing and Power Companies—for the nine months to April 30 stands at $3,242,523, allowing for $675,000 for depreciation and renewal reserve. With regard to the Cedars plant, Sir Herbert Holt states that the "great demand for electricity has compelled the extension of the company's hydro-electric plant at Cedars, notwithstanding the high cost of the work at this time. The work is already in hand, and involves the construction of the substructure for the ultimate development of 180,000 horse-power, although for the present it is only intended to install two additional units of 10,000 horse-power each, and the necessary superstructure for same. With the additional two units, which are prospected for completion in the fall of 1918, the company will have 120,000 horse-power available at this plant." Out of a total force of 1,500, 488 employees have volunteered for overseas.

Further Southern Canada Power Acquisitions

The Southern Canada Power Company is still further extending its operations in the eastern townships. The town of Granby has just ratified a contract with the company for for lighting the town for ten years, and has also granted a franchise for the sale of light and power for a like period, both effective from July 1st. The company acquires the municipal plant, including a reserve steam plant. The contracts involve the construction of a transmission line from Foster, a distance of 16 miles, where the company has a water power. Additional machinery is necessary, as well as the enlargement of the flume. The company has also made arrangements for taking over the municipal plant at Bromptonville, for light and power, which necessitates the construction of a transmission line from Sherbrooke.

"Punch" portrays the Potatriotism of The Electric Club of Toronto.

Instantaneous Selective Relay Protection for A. C. Transmission and Distributing Systems

By P. Ackerman before C. E. A. Convention

The rapid growth of a.c. transmission and distributing systems, making the supply of thousands of customers with important loads depend on a few transmission wires exposed to all kinds of atmospheric and accidental interferences, has brought the importance of a proper relay protection clearer to our mind.

The original idea of using relays for protection of apparatus from overheating due to limited overload conditions has been dropped, at least as far as main systems are concerned, leaving the watching for overload conditions to the operator or providing special signal apparatus to call the attention of the operator.

Relays are now entirely considered as protecting devices for sectionalizing short circuits, without interrupting the rest of the system; in other words, they shall protect the system from unnecessary interruptions.

To accomplish this in the most effective way the system should be provided with relay schemes which will disconnect instantaneously and selectively any faulty part. Instantaneous action of the relays will assure the least power arc destruction to the apparatus at fault and will cause the shortest possible voltage disturbance on the system, thus saving synchronous load from falling out of step.

Selective action will assure the disconnection of the faulty apparatus without interruption whatever if the apparatus was operated in parallel with others, or with local interruption only to the load connected to the faulty apparatus if it is an independent feeder.

Little progress has been made on this continent towards accomplishing this perfect state of protection. The reasons for this slow progress are manifold.

The Merz-Price System

The Merz-Price system, so extensively and satisfactorily used in England, is not so well suited for our conditions of chiefly overhead transmission and has, probably for this reason, not been able to make any great headway.

Too much energy has been concentrated by the relay manufacturer on improving the old principles applied particularly in trying to improve the reverse current relay, overlooking the fact that the principle was unable to act correctly under all short circuit conditions.

The problem of effective relay protection is extremely complex and requires a very intimate knowledge of the whole system. It happens, however, that the manufacturer developing and supplying the relays is lacking in this knowledge and the operating man who would know his system completely is lacking the time to work out these problems. The result of this is that standardized relays are applied which at some places may give fair satisfaction, while at others may be fully unsatisfactory.

Because of the uncertainty of most of the proposed schemes a natural suspicion has developed against any new scheme, with the result that the operator prefers to operate entirely unprotected rather than depend on an uncertain relay protection.

These are probably some of the chief causes why the development of effective relay schemes has made very slow progress, and why the possibilities of effective instantaneous selective protection of whole transmission systems has been overlooked, although effective schemes have been devised in individual cases within the last few years.

A System of Time-Limit Relays

Present day practice of relay protection of a.c. systems is to provide a system of time-limit relays, providing the farthest distant feeders with the smallest time element and increasing this time element progressively toward the generating station, the object of this graded time adjustment being to allow faulty far distant feeders to sectionalize from the main system without extending the interruption to any larger section than the one affected.

On large systems the highest time settings reached toward the generating station may easily be as high as two seconds definite time, which means that short circuits occurring in the main system may hang on for this length of time, before being cleared, with the result that usually the synchronous load of the whole system drops out of step and the power arc destruction on insulators, line cables or underground cables becomes excessive. Also, with graded time protection only, a smaller or larger part of the system will always be interrupted, as no selective disconnection of faulty parts, being operated in parallel with others, can be expected.

Selective Disconnection

Selective disconnection of faulty parallel operated lines has been attempted with more or less success with the combination of time limit overload relays at the generating end of the lines and reverse current relays at the receiving end. This combination has always failed to be absolutely dependable, chiefly due to the inherent weakness of the principle applied to the reverse current relay. Practically all of them are built on a wattmeter principle, requiring an interaction between current and potential coil to cause the movement which closes the relay contacts.

With short circuits nearest to the receiving station, our potential is liable to be pulled down to zero, and the power factor of any short circuit current is very low. A wattmeter cannot move without voltage and moves slowly only with low voltage and low power factor. A reverse current relay based on this same principle cannot possibly act differently, and it is quite evident therefore why it was found so unreliable when used for selective protection of parallel lines.

It is true considerable efforts have been made to improve and correct this inherent weakness, and relays are now obtainable which are operative down to 1 to 2 per cent. voltage and in which the effect of the low power factor has been corrected and a marked improvement in their effectiveness has no doubt been established, yet the fact remains that they will be unable to take care of all possible short circuit conditions from one end of the line to the other one.

Furthermore, their combination with time limit relays at the generating end causes generally the line short to hang on the system sufficiently long to cause the dropping out of step of most of the synchronous load.

From this it will be realized that effective dependable and selectively acting parallel line protection can only be expected by applying a principle which does not require a doubtful potential element and which does not require time-limit relays at the generating station end of the lines.

For many years past it has been realized that other principles are available to cut out faulty parallel lines, but so far only very limited use has been made of them.

Instantaneous Protection

The idea of instantaneous selective protection is not new and has been developed to a very great state of perfection by Messrs. Merz & Price in England. Their principle can be applied to any piece of apparatus; it bases on the fact that the current flowing into an apparatus and out of it is always the same in magnitude and direction as long as the apparatus is perfect; the instant a fault develops in the apparatus this current balance between inflow and outflow is disturbed and the difference between those two currents is made use of to actuate a relay and disconnect the faulty apparatus.

For generator, transformer and short cable protection this principle is very satisfactory and can hardly be improved and deserves a more extensive use on this continent than it has found in the past.

For long cable runs and overhead lines the Merz-Price principle is not desirable because of the need of pilot wires required between the two ends of the lines. In this case parallel lines are preferably protected by making use of the fact that the currents of the same phase of parallel lines are balanced normally but unbalanced in case of a short within any one of the parallel lines.

This principle depends entirely on current elements and is accordingly absolutely effective for any kind of short circuits. It can be applied in many different ways, the difficulty, however, lies in the development of a practical form which makes it foolproof and does not require any attention on part of the operator.

This principle has been successfully used for the protection of the 60,000 volt lines Niagara Falls-Toronto of the Toronto Power Company, a parallel feeder protection being in service since January, 1916, and a double line protection since April, 1917. Both protective schemes have cleared to date 34 line shorts without a single failure. The following data give an idea of the different causes of the shorts and the effect on the load of the system.

A.—Line Shorts Cleared by Relay Protection Tabulated According to Causes

Cause	Number of Shorts
Lightning	10
Sleet and wind	4
Insulator failure (chiefly old insulators in operation since 1906)	15
Line tests (to prove effectiveness of relays)... ..	4
Unknown	1
Total	34

B.—Effect on Load

Amount of load lost	Number of shorts
None	26
Less than 20 per cent.	5
20 to 50 per cent.	3

A similar instantaneous selective protection for the Toronto 12,000 volt underground distribution between the terminal station and the sub-stations will be completed shortly.

It is felt that after the completion of this protection the main transmission and distributing system should become almost immune to total or large partial interruptions, except in case of bus-bar shorts, switch failures or operators' mistakes.

The graded time protection has still been maintained to a limited extent; its function in the main system, however, has changed to a kind of standby to cut out the whole sub-station in case of sub-station bus-bar shorts or should, for any reason the instantaneous relays or switches fail to act. The time protection should, however, hardly ever have to come into action.

Not every system is as favorable in its layout to permit a perfection of protection which we believe to have reached, but by properly harmonizing design, operating needs and selection of protective devices it should be possible to develop an effective instantaneous selective protection for almost any system.

The question of protection, however, cannot possibly be standardized as it is too largely dependent on local conditions and for this reason no details of the schemes applied are given, the intention of the paper being merely to show the great prospect of operating improvements by the use of relays based on current balance.

Verdun, P. Q. Installing Underground Work

On May 21 last the Municipal Council of the City of Verdun, P.Q., approved the plans and specifications for a system of underground conduits, to be constructed in the immediate future, covering the principal streets of the city, namely: Wellington Street, from the eastern city limit at May Avenue to First Avenue; LaSalle Road, from Wellington Street to Fourth Avenue; and Church Avenue, throughout its entire length, from LaSalle Road to the northern city limits at Bond Street. In all approximately 2½ miles of streets will be covered, and the plans call for about 25,000 trench feet of duct runs, of an average section of twelve ducts.

The type of construction will be "monolithic," using 3½ in. square bore mains and 3 in. fibre signals and services, the duct mass being encased on all sides by a 3 in. envelope of concrete. As no high-tension cables are to be installed in the systems, the concrete separation between the signal and main ducts has been specified at 2 in., which will afford ample protection to the signal cables in case of a burn-out in a main cable in the duct run. The signal cables are to be protected in the manholes by a cement covering.

The main manholes at street intersections are to be 7 ft. 6 in. by 5 ft. 6 in. deep, which will give sufficient room in the [illegible] future extensions of the system up the side [illegible]

The service manholes are 6 ft. by 4 ft. by 6 ft. deep and all ducts open into every service manhole.

All service manholes will be provided with a connection to the sewer, fitted with a back-water trap. Copper bus-bars will be installed in all manholes and connected to ground cones. The cable sheaths will be bonded together to the bus-bars, thus effectually grounding the cable system in every manhole.

Provision for Various Services

Provision has been made in the duct allotment to provide for the cables of the Montreal Light, Heat and Power Company, the Montreal Tramways Company, the city power and lighting services, the city street lighting system, and the combined fire alarm and police patrol system. Sufficient "spare" ducts have also been provided to take care of all probable extensions to the system for the next twenty-five years. The Bell Telephone Company has not reserved any duct space in the new conduit system, as this company has a duct system of its own, covering a large portion of the city.

The sidewalks of Verdun are, for the most part, on the streets to be covered by the new conduit system—constructed with a turf strip between the cement pavement and the curb. It is proposed to install the conduit runs in this turf strip wherever possible, in order to save the cost of repavement.

This will necessitate the moving of a certain number of poles which are now installed in this turf strip, the cost of which is estimated at about ten dollars a pole, as it involves merely the kicking outward of the butts of the poles without cutting over any wires. As the cost of the repaving represents approximately 25 per cent. of the cost of the duct sections, a substantial saving should be effected by the utilization of this turf strip.

Using Lanes Wherever Possible

Advantage has been taken wherever possible of the lanes where they run parallel to the main streets, and pole lines will be installed in these lanes to feed the buildings from the rear. Connections will be made to these pole lines by lateral ducts running from the main manholes at street intersections to a pulling hole at the corner of the lane, and from there to a cable pole in the lane.

Buildings on the south side of LaSalle Road, from Church Avenue to Second Avenue, will be fed by a specially-constructed pole line on the dyke bank.

Where no lanes are available, service ducts will be run from service manholes into all buildings, and service ducts will be dead-ended at all vacant lots, to take care of the future buildings.

Special transformer manholes will be provided for the Montreal Light, Heat and Power Company and the city power and lighting system at locations to be determined upon. The cost of transformer manholes and lateral pipes to cable poles providing entrance to or exit from the conduits will be charged directly to the company or civic department requiring same.

Rental will be charged on the number of duct feet reserved for each of the various companies or civic departments, and the charge per duct will be sufficient to provide a sinking fund for the amortization of the bond issue in forty years and for the maintenance and operation of the system during that time.

It is expected that the work of construction will be begun this month and carried to completion in the fall.

Ornamental Street Lighting System

The ornamental street lighting system which is to be installed and put into operation immediately upon the completion of the conduits, consists of one hundred ornamental incandescent lighting fixtures mounted upon specially designed cast iron standards, spaced at average distances of 125 feet on alternate side of the streets covered by the conduit system. The new lights will replace the present aerial 4 amp. arc lamp. The lighting units are to be series 6.6 ampere incandescent nitrogen-filled lamps, 89-400 candle power and 11-250 candle power.

One standard is provided at every street intersection and two standards at important intersections. Special lighting is also provided for the small parks at the intersection of Wellington Street, LaSalle Road, and Mullarkey Avenue. The height from the ground to the centre of the lamps is to be 14 ft. 6 in., and at 125 ft. spacing the 400 candle power lamps will furnish an intensity of light on the street practically equivalent to "White Way lighting."

The cables for the lamps are to be installed in a special 3 in. fibre duct, to be provided at the upper outside corner of the duct mass, which will be looped into all standards.

The cable to be used is No. 6 B. & S. gauge single conductor stranded copper, paper insulated, lead covered, 7,500-volt cable. About 1,700 feet of the same type of cable, covered with a double layer of steel tape armor will be used on the south side of LaSalle Road, from Church Avenue to Second Avenue, where no conduits are to be built at present.

The lamps will be connected in two circuits of 50 lamps each, so arranged that, with the exception of short sections of street, a trouble on one circuit would extinguish the lamps on one side of the street only.

The standards will be installed on concrete foundations 3 ft. deep, 20 in. square at the top and 24 in. square at the bottom. These foundations will securely anchor the standards so that the heaving of the ground by the frost in the spring will not throw the lamp out of plumb.

The cut-outs to be installed in the pedestal of the standards will be of the film type which has proved successful in installations of a similar character. Access to the cut-outs will be provided by a door in the pedestal of the standard.

The power for the system will be purchased from the Montreal Light, Heat and Power Company, at a cost of $27.50 per horse-power per year for 24-hour service, delivered at the city waterworks and power house, at 2,200 volts.

Two 22 kw. double coil repulsion type, 6.6 ampere, constant current transformers, will regulate the current for the lighting system.

Extension of the system up the side streets is contemplated in the future. Double conductor armoured cable will be used to feed lamps to be installed on one side of the side streets only, and the new lamps will be connected to the present circuits.

Combined Fire Alarm and Police Patrol Systems

Immediately upon the completion of the conduit system, and at the same time as the lighting system in installed, it is proposed to install the cables, pedestals and station apparatus for a combined fire alarm and police patrol system.

The specifications for this system cover the changes in the present fire alarm system to be made necessary by the removal of the aerial wires and poles on the streets covered by the conduit system, and the installation of a new combined underground system that will provide the city with a most modern, efficient, and economical fire alarm system and police protection service.

All of the fire alarm equipment now in use will be retained in the new system and its efficiency will be increased by the addition of apparatus to provide a permanent record of each alarm showing the number of the box pulled and the exact time and date of its operation.

Current will be furnished by means of a storage battery operated in conjunction with a motor-generator set designed to take power at 110 volts, alternating current, 60 cycles, and to furnish direct current at 110 volts. The complete storage battery and motor generator installation will be placed in the basement of the City Hall.

The Gamewell System

The police signal and duty recording system will be of the "Gamewell" type, and will have provision for two telephones and duty circuits and three flashlight circuits. The duty calls will be recorded by perforations on a paper tape, showing the box number, the time, and date. By means of a separate signal a wagon call will be indicated as such, in order that, without having to communicate with the officer, the patrol wagon may be at once sent to the box operated. A telephone signal and circuit will also be installed, so that the patrol man may be answered from the desk by the operation of the answering key. A large, loud-ringing extension bell will be used in order that the patrolman may get prompt attention from the officer on duty at the desk.

The outgoing signals will consist of a flashlight, a vibrating bell, and a buzzer telephone. The flashlight will be operated from the desk, and will be so arranged that the flash can be sent out to indicate any predetermined number of times automatically or to be hand-controlled by a key to give code flashing.

Continuous burning of the light is to be possible by operating certain switches on the desk. The vibrating bell will be operated in the same manner as the lights, and will give signals intermittently, in code or continuously. The buzzer signal to the telephone will afford a means of silent calls, and is to be so arranged that when a box is opened for a duty report the officer can be called by the buzzing of the receiver.

The combined systems provide for 11 combination pedestals with lamp and bell on upright shaft, arranged to support, on opposite side one police box and one fire alarm box, and eight single pedestals arranged to support fire alarm box only.

Multiple Conductor Cable

The cable to be used will be multiple conductor, made up of three pairs of No. 14 B. & S. gauge solid and three single conductor No. 10 B. & S. gauge solid rubber insulated conductor. The insulation wall on each conductor will be 3/64 in. thick. The No. 14 conductors will be twisted together in pairs with jute, and one conductor in each pair marked for tracing and taped overall. The three No. 10 conductors will be stranded together with one conductor marked for tracing and taped overall.

The three pairs of No. 14 will furnish service for fire alarm, telephone, and signal circuits respectively. The No. 10 conductors will be used for supplying current at 110 volts to the bell and lamp at each pedestal.

Mr. A. S. Clarson, City Engineer, Verdun, P.Q.

A certain amount of aerial construction will be made necessary by the extension of the police circuit from Regina and Wellington Streets along Regina Street to Verdun Avenue, and then along Verdun Avenue to Mullarkey, where no underground conduits are at present to be installed.

As soon as the lighting, fire alarm, and police patrol systems are completed it is proposed to install the cables to serve the customers of the city lighting and power service. It is hoped that the operating companies will shortly after install their cables in the ducts reserved for their use, and enable the unsightly poles and wires to be removed from the streets, which will then present an appearance of which the citizens of Verdun will be justly proud.

The entire work of the preparation of the plans, specifications, etc., and the supervision of the work of construction is in the hands of Mr. A. S. Clarson, C.E., consulting municipal engineer of Montreal, who also occupies the position of city chief engineer of Verdun.

A telephone system is being constructed at Quill Lake, Sask., by the Lake [illegible] Rural Telephone Company.

The Cost of Poor Lighting

The salesman frequently enough hears the complaint of the "prohibitive" cost of good lighting, but it is not generally appreciated by factory managers that poor lighting is infinitely more expensive. This is doubtless a fact, however, in that inefficiency on the part of the workman is a much more serious matter in the average factory than the management are aware of. This point is brought out very clearly in an article in the Electrical World of June 2, by C. E. Clewell, assistant professor of electrical engineering, University of Pennsylvania. Prof. Clewell calculates that the cost of proper lighting is merely the equivalent of two minutes lost time of the workmen concerned. The details leading up to this conclusion are given in the following extract:

Comparison of Lighting Costs and Wages

To reduce the findings for a particular plant to a more tangible basis it is interesting to outline the total costs of lighting for a given floor area in terms of the wages for the same floor space. To do this, consider a factory bay 16 ft. x 40 ft. Here ten 60-watt tungsten lamps are mounted at the ceiling of a comparatively low factory section. The total floor area of this unit bay is 640 square feet, a space which will easily accommodate five or even more workmen. The fact that a single bay of this kind will accommodate, say, ten or even fifteen workmen does not warrant the assumption of these higher numbers, since throughout a large factory the distribution of materials and machines will probably reduce the average workmen per bay to the lower number. By taking five men for this unit area a more conservative rating of the wages per unit of floor space is thus assumed.

Under the further assumption that these five men normally work eight hours per day, at the rate of $4 per day, the total wages per day per bay amount to $20. With overhead charges of 100 per cent. for superintendence, etc., the total labor charge per day for the bay is $40, which is equivalent to $5 per hour, or to about 8 cents per minute.

From the lighting standpoint it may be assumed that the ten lamps burn 2,000 hours per annum, resulting in an energy consumption of 1,200 kw. hour per annum. The maintenance charge, including renewals and lamp and reflector cleaning, may be taken at about 1 cent per kilowatt-hour, and the energy charge at, say, 2.5 cents per kilowatt-hour. Hence, the combined energy and maintenance charge per bay amounts to $42 per annum. Adding to this an interest charge of 6 per cent. on the first cost of the installation (assumed as $50), the annual interest amounts to $3; and a depreciation charge of 12 per cent. on the "non-renewable" value of the installation (taken as $37.50) amounts to $4.50, giving as a total for the operating cost of the lighting per bay per day a value of about 17 cents.

From these relations the interesting deduction may be made that if the good lighting conditions make it possible for each workman to save as much as about two minutes per day of eight hours, the wages corresponding to this time will pay for the entire cost of lighting for the day. To appreciate what this means to the industries, it is only necessary to review the testimony of managers, superintendents, foremen, and workmen as contained in the above account of the experiences in an actual plant, where losses of as much as several hours occurred under an old and inferior system. To find from a canvass of a plant, poorly furnished with light, that losses of an order of magnitude of 30, 60, or even 120 minutes are occurring per day, when a total expenditure equivalent to the wages for two or three minutes per day will eliminate most, if not all, of these losses, can well form the basis for the most telling arguments in favor of necessary improvements.

Electric Steel Industry in Canada

By A. M. Tirbutt, Selkirk, Man.

[The extreme importance of the electric steel industry and the rapid developments that have taken place in the last five years has been emphasized in our last three issues in a series of articles by Mr. George M. Berry, chief chemist of the Halcomb Steel Company, Syracuse, N.Y. The present paper, recently read before the electrical section of the Manitoba branch of the Canadian Society of Civil Engineers, adds further valuable data to the sum total of our knowledge on this subject. The reduction and refining of iron and other ores by electric heat is one of the most promising developments of the near future in Canada, where supplies of both the ore and the power are found in close proximity and in almost unlimited quantities.—Ed.]

ELECTRIC STEEL

The wonderful growth of the electric steel industry in Canada and the United States during the last few years is best shown, I think, in terms of output. From 18,309 tons made in 1912 it jumped to a total of over 225,000 tons in 1916; and, taking the units installed during the latter part of that year and those at present under construction, the total output for this year, taking a conservative estimate, should easily reach the 500,000-ton mark.

To what is this growth due? The war, and this is so, but indirectly, for the war has created an unprecedented demand for all kinds of steel; but why should not this demand have been met with steel made by other processes? The war gave the opportunity, but qualities inherent in the electric process have enabled the electric furnace builders and users to realize on the opportunity.

Characteristics of Commercial Steel

After saying this I had better briefly touch on the characteristics of the commercial steel of the present day. Besides the electric there are three other processes of making steel—converter, open hearth, and crucible—and, as it is generally recognized that the last process is best adapted to the production of the highest quality steel, I intend to prove that the electric process is adapted to the production of steels as high in quality as crucible steels.

Mr. David Carnegie, in his book, "Liquid Steel: Its Manufacture and Cost," says: "The advent of electric furnaces has arrested, in some degree, the development of the crucible steel process, but not, it would appear, to the extent looked for by the advocates of the electric furnace. One of the chief hindrances in the progress of the electric furnace is the cost of the electric power required in the process, and it is, therefore, in the manufacture of the higher grades of steel, such as are made by the crucible process, that most is expected from the electric furnace. There is no question about the quality of steel that can be produced in this latest type of furnace."

This book was written in 1913, when the electric furnace was looked upon as an expensive equipment to operate. Since then great strides have been made in furnace efficiency, which, were I dealing with costs, I could very easily show you.

Dr. John A. Mathews, president of the Halcomb Steel Company, of Syracuse, N.Y., a company which operates a large number of crucible furnaces, as well as three large electric furnaces, said in a paper read before the American Iron and Steel Institute in May, 1916:

"With the advent of electric furnaces we have a rival which claims to make steel equal to the best crucible steel. It is interesting to note that the inventors recognize the superior qualities of the crucible products so frankly. Equally frankly I can say, after ten years' experience, that I think they are right."

The reason for the superiority of crucible steel over open hearth and converter, according to experts such as Mr. Bradley Stoughton, is because it is manufactured in a vessel which excludes the air and furnace gases, and is, therefore, free from oxygen, hydrogen, and nitrogen, whilst the process is also under a little better control and receives more care than the other two.

Better Control With the Electric

The control possible with the electric furnace is greater than with the crucible process. For instance, there is always a certain amount of uncertainty as to the amount of carbon content of crucible steel when using plumbago crucibles and to the silicon content when using fire-clay crucibles, whilst the silicon and carbon, as well as other elements, can be controlled perfectly in the electric furnace. Heats can be held in the furnace until accurate analysis are received from the laboratory, after which you can proceed to eliminate anything unnecessary or by adding the necessary materials get the desired chemical analysis in the finished product. In fact, of all the metallurgical steel furnaces the electric furnace is the most susceptible of accurate control with the heat applied directly to the metal in the cleanest way possible—i.e., without the admission of coal, ash, or gas, or air of the blast. The atmosphere in the tightly-closed electric furnace can be made oxidizing, neutral, or reducing at will, according to the slag. In fact, a heat can be held for hours under a neutral slag without changing its quality, or a part of the heat may be cast and the balance worked over to another grade, a convenience which is of great importance to steel founders, especially when big furnaces are used.

The elimination of sulphur is easy in an electric furnace, as, owing to the high temperature available, a much more basic slag can be used.

Dense Structure and Higher Tensile Strength

A characteristic peculiar to electric steel is its dense structure and high tensile strength. For the same chemical analysis electric steel has a denser structure and higher tensile strength than steel made by any other process. What causes this density of structure has never been discovered, though it may be due to some magnetic influence on the molecules. If a converter, open hearth, or crucible man be shown a fractured test bar of electric steel and asked to judge the carbon content he will invariably estimate five to fifteen points too high.

The average ultimate strength of electric and open hearth steels for the following range of carbon contents per cent. is interesting:

Carbon content	0.08	.12	.20	.24
Electric (pounds per square inch)	59.194	64.080	72.853	69.540
Open hearth (pounds per square inch)	51.690	56.510	58.294	63.560

The Thomas Davidson Manufacturing Company, of Montreal, have been melting steel scrap in an acid electric furnace and casting billets for 4.5 h.e. shells for nearly a year, and their record is remarkable, over 90 per cent. of the billets having passed the rigid inspection of the Munitions Board. An average analysis of twelve successive heats poured by this company is as follows:

Carbon, 0.447; silicon, 0.19; manganese, 0.80; sulphur, 0.044; phosphorus, 0.04; yield per gross ton, 21.8; tensile strength gross ton, 44.6; elongation, percentage, 23.4.

Three Reasons for Superiority

Summarizing the characteristics of electric steel, it is my opinion that it can be produced superior to steel made by any other process now in use, because:

1. The steel can be made more uniform in chemical content, and specifications can be more closely met, due to the conditions in the electric furnace and to the process, which is ideal for the controlling of the carbon, silicon, manganese, phosphorous, and sulphur.

2. The steel can be made more solid and free from blowholes owing to the exclusion of oxygen and the ability to kill your melt by the judicious use of alloys at the right moment.

3. The steel has a denser structure and a higher tensile strength, due both to the exclusion of oxygen and nitrogen and to the peculiar reaction which occurs in the electric process. This, of course, is true in the case of any of the electric furnaces in use to-day if they are properly handled.

Furnaces Classified

Now, with regard to the classes of electric furnaces used in iron and steel production, there are three, namely, arc furnaces, resistance furnaces, and indirect furnaces, so called according to their methods of applying electric heating.

In the first the heat effect is produced by radiation, or conduction from an electric arc. In the second the heat effect is produced within the metal itself by the resistance offered to the passage of the current through it. Whilst the induction furnace is really a large transformer, in which the molten metal is the secondary.

Of the three classes the first, or arc furnace, is really the only one which has been made a commercial success up to the present in the manufacture of steel, though in refining some of the lower fusion point metals, especially aluminium, the resistance type is used extensively, the best-known being the Rochling-Rodenhauser, or combination, furnace.

Arc furnaces have been used for some years successfully in refining steel in combination with open hearth and converter furnaces, and still are, but it is those that are used for converting cold scrap into casting and ingots that are interesting to us Westerners, away from the big iron centres.

Of these furnaces there are only four makes, according to my mind, which can lay claim to being a commercial success on this continent, and they are the Heroult, the Girod, the Gronwall Dixon, and the Snyder, and I would like to say a few words about each of these.

The Herault (Arc)

The first English patent for the Herault furnace was taken out in 1900 by Dr. P. Herault, and his original design has undergone little alteration up to the present day, the chief alterations being that the electrodes have been changed from square to round, and the location of the charging hole changed from the side to the back of the furnace. Perhaps a general description of the Herault furnace would not come amiss here.

It consists of a closed shallow iron tank, thickly lined with refractory materials. The bottom of the furnace is lined with dolomite brick and crushed dolomite. These materials are also used for the sides below the level of the molten metal. For the openings and portions of the furnace exposed to the corroding action of the slags, magnesite brick and crushed magnesite are used, whilst the roof of the furnace, which suffers most from the high temperature, is built up of silica bricks. The whole furnace is mounted upon toothed and curved bars, which allow for the furnace being tilted—held at any angle for discharging purposes.

The carbons are supported by an insulated framework fixed to the back of the furnace, and can be moved vertically by a set of gears.

The first furnace was used with d.c., but they are now built for two and three phase a.c. As the carbons do not burn away equally, automatic regulators of the Thury type are usually used to help maintain the arcs at a constant length. The largest Herault furnace that I know is, or was, in operation in Bruchausen, Germany. This has a capacity of 25 tons, but was run in conjunction with an open hearth furnace and only used for refining. I think five tons is the capacity of the largest scrap melting furnace in this conutry, and I believe the average power consumption for the Herault type furnace run about 600 kw. hours per metric ton of cold scrap melted and refined, and the consumption of electrodes about 20 pounds per ton.

The Girod (Arc)

Now for the Girod. This is a different type of furnace, and, although I said it could claim to be a commercial success, its costs are such that it is really only practicable when absolutely first-class metal is required for gun steel, etc., and is, in fact, a specialist's furnace.

It is peculiar in construction, inasmuch as it has water-cooled steel studs imbedded in and protruding through the crushed dolomite hearth. When used with d.c. these are generally six in number, connected to the negative side of the power plant, and placed as far as possible from the vertical carbon electrodes, either three or four in number, and being of a like polarity, and which hang vertically through openings in the arched roof, which is made of silica brick.

The lower ends of the carbon electrodes are kept adjusted so that they almost touch the slags, but not quite, so as to form an arc between these and the slag Since the bottom electrodes are as far as possible from the upper ones, the current passes through all the charge, and by this means the whole mass is uniformly heated. The current in crossing the bath also produces an electro-magnetic field, which gives the bath a rotary movement, which quickens and helps the chemical reactions.

The furnace can be used with any current continuous, 1 ph., 2 ph., and 3 ph., the e.m.f. required being about 65 volts. In the case of a.c., it is best to have a low frequency, on account of the effects of self-induction, which are very noticeable if anything over 50 cycles are used. If three phase current is utilized a special star connection is used, the principle of the connection being that one of the phases is reversed in relation to the other two.

Another thing that has to be watched carefully is the cable arrangements for conveying the current to the furnace, as, if these are not arranged systematically around the furnace, induction losses will be heavy, and there will also be unequal heating in the bath.

Although the costs of this type of furnace are high—nearly 900 kw. hours per ton of molten metal produced—its high temperature, smooth working, and uniformity of product make it not only practicable, but almost necessary for the manufacturer who requires only the best and highest-priced steels.

The Snyder (Arc)

We now come to the Snyder. This type of furnace has come to the fore in the last few years, and has been, until the present, a single-phase proposition; but, owing to the size of the furnaces increasing and the efforts of everyone to cut the time from the changing of the cold scrap to the pouring of the heat to the minimum—that is, a certain weight of metal requires so many kw. hours of electricity to complete the heat according to the grade of steel required—the maximum load of the present-day furnace is raised to the limit, and, as most power companies are three-phase systems, the single-phase furnace user is always in trouble with the power company through unbalancing and interfering with their regulation. If the furnace was located in the proximity of the power house and could draw its current direct from the main bus bar with a big reserve of power behind it, all would be well, but the location of a power house is usually not at all suitable for the location of a foundry. Of course, all this can be got away from by the use of a motor-generator at the foundry, and this, in my opinion, is the ideal proposition—i.e., a single-phase furnace operated by a motor-generator set.

The original cost of an installation of this description is, of course, a great deal more than that of the single transformer, but the benefits derived from it more than compensate for this, and usually it will pay for itself before very long, as most power house men will make an allowance in their rate if the rate is based on the power-factor; and, as you know, with a synchronous motor driving your generator, you can keep the power-factor at unity. But as first cost has a lot to do with selling furnaces to-day, the Snyder people are now including a Scott connection in their equipment and selling a two-phase furnace.

The Snyder single-phase furnace is simple in construction, consisting of a spherical steel shell, the top quarter of which tilts back to an angle of 80 degrees, by means of a motor-driven attachment to allow for placing your whole charge in the furnace at once by the use of a crane, whilst the whole furnace revolves on an arc, of which the spout is the axis of the circle, by another motor control for pouring.

The bowl of the furnace, or part that contains the charge, consists of, in the case of an acid furnace, tamped ganister bonded with fire clay and gluterine, whilst the roof is formed of specially designed fire brick, forming an arch. The top electrode is made of graphite, and projects through the centre of the roof, and is held by a copper crane or carrier, which tilts back with the roof and also raises or lowers the carbon vertically by motor control. The bottom electrode is of copper and water cooled. This furnace is operated at a high voltage, viz., 220 volts, and in the case of a two-ton furnace required 800 kw. at full load. This type of furnace, owing to its high voltage, quickness of charging, etc., is very fast, and will give an average of ten heats, or twenty tons of molten metal in the twenty-four hours.

In general practice for castings, etc., a quick furnace like the electric should not be of larger size than two or three tons, as although this limits the size of a single casting to that weight, it will generally be found, as a commercial matter, profitable to get anything larger cast outside, because the smaller the furnace the more heats per day and the more times the floor can be poured off, and the smaller your floor the smaller the building to cover it, and the smaller your overhead charges, capacity of crane, ladles, etc.

Several Functions to Perform

An electric steel furnace has several functions to perform. It has to hold the metal bath, keep the heat produced from getting away, and support the electrical apparatus for introducing the current.

For the first two reasons an electric furnace should have as large a volume as possible and as small an outside surface; therefore, as of all geometric shapes, a sphere has the largest ratio of volume to surface, a furnace should be as nearly spherical as possible. As a single-top electrode gives you the best chances for carrying this out, it is, in my opinion, another point in the favor of the Snyder single-phase furnace.

Another point which amounts to a surprisingly large figure in continuous working is the electrode consumption. In a single-phase furnace this consumption is not much more than a third of that of a three-phase furnace of the same size, and as this is approximately six pounds per electrode a ton of metal melted and graphite electrodes cost about 15c per pound, you can figure this out in dollars per ton. The loss of energy or resistance per square inch of electrode also comes into account. Whilst another very important feature of the single-phase furnace is the saving in refractories, as it is here possible to place the source of heat at the maximum distance from the walls.

Electric furnaces can be lined either acid or basic, and which should be used is determined entirely by commercial considerations, as either lining, when properly put in, is equally reliable and convenient in operation. With a basic bottom refining can be done. To do refining cuts down the output per day in tons, and therefore increases the costs of labor, electricity, electrodes, and refractories per ton of metal melted, as well as the basic bottom material being a great deal more expensive than the acid bottom ganister, but steel scrap which has to be refined is much cheaper than steel scrap, which can be melted and poured without refining, and it is usually cheaper to run basic, especially on casting work where varied specifications have to be met. Should the local market conditions change so that the purer scrap can be purchased low enough, or you get a long run of billets or something of an analysis which can be met by using a scrap procurable without much refining being necessary, then you can change your lining to acid in a few days, as the kind of lining used does not effect the rest of the construction of the furnace, with the exception that the acid-melting process is fiercer and harder on your arc control apparatus.

The Future is Promising for the Electric

In finishing, I would like to state that, in my opinion, the strides which the electric furnace has made in the last few years in steel and alloy-making is nothing to the developments which are going to take place with electric furnaces in the next few years when this country of ours begins to develop her mineral resources. As water power is abundant in most mineral districts notably copper, zinc, tin, and nickel, power plants and furnaces for at least the first stages of refining will be installed right at the mines, thereby allowing for the removal of the dross right on the spot, with, therefore, the high freight rates to the present smelters on the useless part of the ore saved, and I even think iron ore will be treated the same way. Some of you may be wondering why ordinary smelters are not erected on iron ore properties, and this was done in the early activities, but were discontinued for the following reason: The heat produced by a coal or gas flame will only reach a certain maximum temperature of 1,700 degrees centrigrade, however much developed, and as this was found not hot enough to refine ore from many fields, it was found necessary to mix the ores from different places in order to properly refine it; and, as this required much shipping of ores, it was found best to ship it all to certain centres and have the smelter there. This state of affairs does not affect the electric furnace at all, as your range of temperature with an arc handled through slag is so tremendous, whilst, as said before, the resistance type furnace can be used for the low fusion point metals; also ores containing 3 per cent. of titanium are not accepted by smelters, but these will be able to be utilized now.

General Costs

Perhaps before finishing it would be well to mention a few words as regards general costs. You will notice I have kept away from this as much as possible, as if I erred one way the furnace builders and sellers would be after me and if the other way, the purchasers of steel castings would be equally wrathy; whilst if I told the truth, both sides would be after my blood. Nevertheless, with a modern three-phase furnace the costs per ton for reducing cold scrap to a good grade of steel and allowing time to make an analysis before pouring, would be:

Electric power, 750 kw. at ½c	$3.75
Electrodes, 20 pounds at 15c pound	3.00
Refractories	2.50
Slag material	.70
Labor	2.00
Making a total of	$11.95

Whilst with a single-phase furnace it can be done for:

Electric power, 600 kw. at ½c	$3.00
Electrodes	1.25
Refractories	2.00
Slag material	.70
Labor	1.80
Making a total of	$8.75

These figures, I am afraid, will not agree with any costs you may see printed, as they are up to date. Any figures which I have come across must have all had their calculations based on before-war prices.

The Rennerfelt

With regard to the "Rennerfelt," this is one of the newer types of furnace and is peculiar as to the method of its electrode arrangement. It is really a two-phase system, run off a three-phase supply, and has three carbons, two entering practically horizontally from the sides and one through the top.

The three-phase current enters the transformers and is changed by means of a Scott connector to a two-phase three-wire system, the vertical electrode carrying about 40 per cent. more current than the two side ones. This has the effect of mushrooming the arc downward on to the bath, and it also helps drive the heat away from the roof, which is an advantage. One disadvantage of this furnace for steel-making, to my mind, is that, although this furnace is very steady, the bath is so quiet that it takes longer to eliminate the impurities, but this same characteristic is an advantage in the dissolution of other metals.

New Books

Examples in Battery Engineering — By Professor F. E. Austin, E.E., Hanover, N.H. Published by the author; price $1.25. This book is written in view of the increasing use of primary and storage cells and the greatly extended applications possible in the future. The arrangement of the subject matter in lessons under important subject headings adapts the book for use as a text-book and discussions on the application of theory to practice renders the book useful to electricians and operators of submarines and automobiles. There are 90 pages, 4½ x 7½ inches, cloth bound, illustrated.

Public Utility Rates—by Harry Barker, B.S., Mem. A.I.E.E.; McGraw-Hill Book Company, Inc., New York, publishers; price $4 net. This book is a discussion of the principles and practice underlying charges for water, gas, electricity, communication, and transportation services. The author has attempted to follow the main lines of a broad survey of the rate problem, free from the mass of obscuring detail which necessarily marks individual cases, and in so doing has studied and extracted the best from the numerous discussions and writings of the recent past on this most important and complicated subject. Where divergence of opinion occurs an attempt has been made to present both sides in an impartial manner. The scope of the work may be gathered from the following chapter headings: Development of Utility Regulation; Product and Service Companies; Various Bases for Rates; Details of the Cost-of-Service Study of Rates; Fair Value of Utility Property; Valuation as an Engineering Task; Reasonable Return, Interest, Compensation for Risk; Depreciation as it Affects Utility Rates; Miscellaneous Problems Indirectly Related to Rate-Making; Problems of Railway Rates; Problems of Express Transportation Rates; Rate Problems of Street and Interurban Railway Transportation; Problems of Water Rates; Rate Problems of Gas Utilities; Rate Problems of Electricity Supply Works and Problems of Telephone Rate-Making.

New "Monitor" Office

The Monitor Controller Company, of Baltimore, manufacturer of automatic starters and controllers for all kinds of motor-driven machinery, announces the opening of a new office in Buffalo, at 718 Ellicott Square, under direction of Mr. William G. Merowit. This office will have charge of business in the Western New York territory, also Canadian territory adjacent to Toronto and Hamilton. Mr. Merowit is particularly qualified to serve Monitor System customers because of his previous active experience in the industry.

World's Largest Telephone Cable

The largest submarine telephone cable in the world has just been completed across Raritan Bay, between Eltingville, Staten Island, and Keansburg, N.J., by the New York Telephone Company. It is nearly five and a half miles long and contains seventy-four pairs of wires. The new cable does away with 3,000 miles of open wires and 13,000 cross-arms used on the old land route. Longer cables are in existence across the English Channel and on the Pacific Coast, but these carry only up to sixteen pairs of wires.

Britain's Plan for Electric Supply

The special government committee appointed last March in England to investigate a scheme for the bulk production of electricity is rapidly completing a plan of government control. It is suggested that the country be divided into seven areas, with a company in each area to amalgamate the existing plants. Government control of other utilities in the past has not been particularly beneficial to the consumer on account of large expenditures for arbitration and payments to private companies. It is anticipated, however, that, with government control of electric plants, the rates to the consumer will be materially reduced.

Metal Molding Fittings

The National Metal Molding Company, Pittsburgh, manufacturers of electrical conduits and fittings, have sent out Bulletin Nos. 201 and 400, descriptive of Flexsteel Armored Conductors, conduits and fittings and National stamped steel fixture studs. Each of these bulletins is bound in a separate correspondence folder, suitably indexed for filing either according to the material or to the name of the company. As previously noted, this company has adopted this correspondence folder plan as standard, and has now issued Bulletins Nos. 50, 151, 201, 350 and 400, covering Rigid conduits, Flextube Non-Metallic Flexible Conduit, Flexsteel Products, Locknuts and Bushings and fixture Studs respectively. Announcement is made that other similar bulletins are forthcoming and will be issued as rapidly as necessary revisions can be made, these to replace the loose leaf catalogue formerly issued by this company.

The Faculty of Applied Science of McGill University has conferred degrees for electrical engineering on Baltazar Moas, Havana, Cuba, and William Grant Tyler, Montreal West.

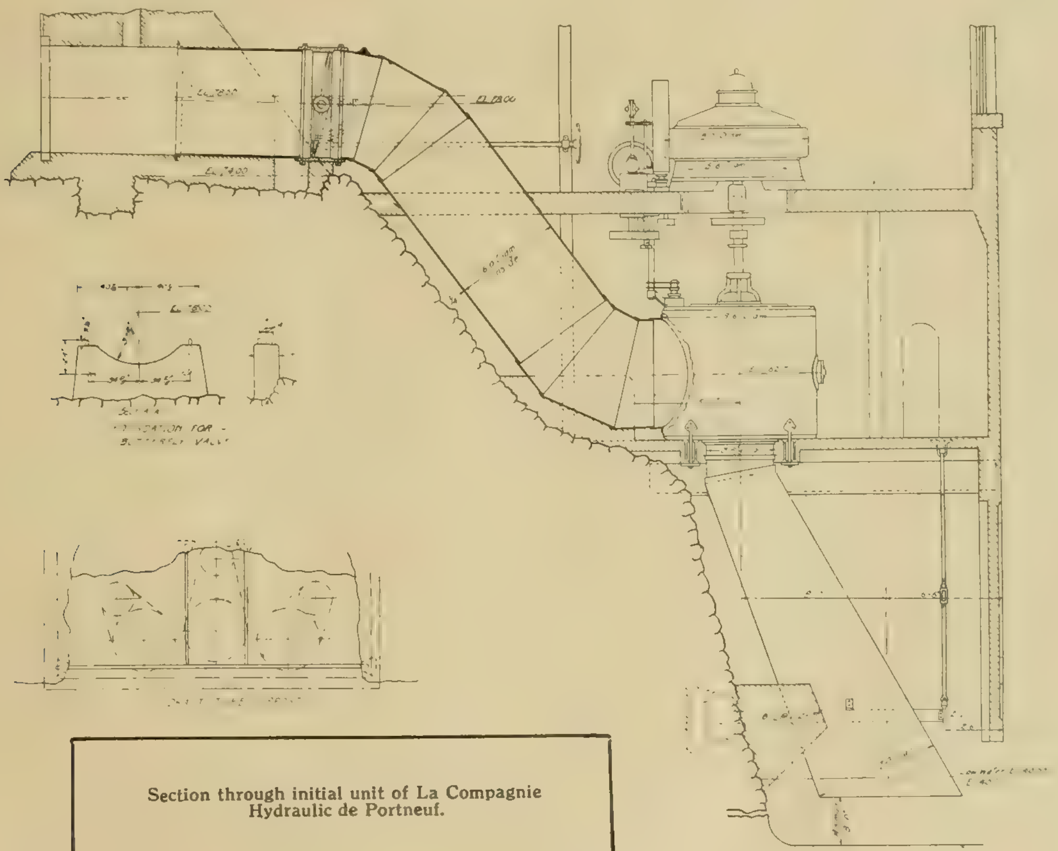
First Unit for Portneuf Hydraulic Company

550 h.p. Samson Turbine—500 Kv.a. Generator—New Plant Will Supply a Number of Villages

La Compagnie Hydraulique de Portneuf, Limitee, have recently completed the installation of the first unit at their power house on the St. Ann's River at St. Alban, Que. Several interesting features from an engineering standpoint were encountered in the building of the main dam, power house, and excavations, due to rock formation.

The first dam across the river was completed in 1914, but owing to faulty construction was carried away by the high water. The company was reorganized, and the new concrete dam completed later in 1914. In the spring of 1915 the new company decided to install the first unit, and awarded the contract for the head gates, excavation, and building of power house to Messrs. Archambault & Conway, of Montreal, who completed the contract in September, 1915.

Considerable difficulty was encountered owing to the heavy rainfall during the spring and summer, which necessitated working under water the greater part of the time to allow of the installation of the draft tubes. After a heavy rainfall of several hours' duration the level of the river would show a rise of seven to eight feet, which delayed the progress of the work. Owing to the heavy rush of water much small rock was washed into the draft tube excavation after a rainfall, which again delayed operation.



Section through initial unit of La Compagnie Hydraulic de Portneuf.

The Turbine Equipment

The water wheel equipment consists of one vertical turbine unit complete. This wheel is of the well-known improved Samson enclosed turbine 35 in., with steel plate case and draft tube. The turbine is furnished with water through a 6-ft. diameter intake pipe. The turbine is controlled by one 6,000-ft. pound Lombard oil pressure governor of the Erie Canal Type.

The unit develops 550 horse-power when operating at a speed of 300 revolutions per minute, the head varying from 35 to 48 feet. The efficiency of the unit when operating under these conditions shows approximately 89.99 per cent.

A 6-ft. diameter butterfly valve, complete with the necessary hand-operating mechanism, is situated in the intake pipe, so that the water can be completely and conveniently closed off from the turbine unit.

The drawing herewith gives a general description of the installation.

Electrical Apparatus

The contract for the electrical apparatus and its installation was awarded to the Engineering Company of Canada, Montreal, and consists of the following:

1 size 24S, 500 kv.a., 300 r.p.m., 6,600-volt, 3-phase, 60-cycles vertical alternator for direct coupling to vertical water wheel shaft.

2 twenty-two kw. type R., vertical, direct current exciters, 125-volt, 950 r.p.m.

The exciter shafts extend through the power-house floor and are driven by pulleys on the water wheel shaft. In this manner all accidents are avoided, as it leaves the floor clear from revolving belts.

The alternator is guaranteed to carry a continuous overload of 25 per cent. with a temperature rise not to exceed 50 to 60 degrees centigrade.

The efficiency guarantees were as follows: P.F., 100 per cent, ½ load, 91.0; ¾ load, 92.8; full load, 93.8; 5/4 load, 94.

Before shipment the alternator was tested at the works of the company and the guarantees were exceeded by approximately 2 per cent. An overspeed test was also given, the alternator running at 625 r.p.m. for 24 hours, without any undue vibration or distortion.

Owing to the possibility of later installing somewhat larger units of approximately 1,000 kv.a., it was decided to use exciters of sufficient capacity to take care of such increase. The present exciters are, therefore, designed to handle the excitation of the largest machine which can be installed in the power-house. The switchboard is of standard design for a unit of this capacity, with no unusual features.

The lines of the company extend to the villages of St. Alban, St. Marc. Des Carrieres and Deschambault, Que. The transmission line voltage is 6,600, which is stepped down to 2,200 and 550/110 volts at St. Marc. for light and power and 110 volts at St. Alban and Deschambault.

The consulting engineer for the company is Mr. De Gaspe Beaubien, Montreal. The water wheel equipment was manufactured and supplied by the William Hamilton Company, Ltd., Peterboro, Ont.; the electrical apparatus was manufactured by the Electric Machinery Company, Minneapolis, Minn., and supplied and installed by their representatives, the Engineering Company of Canada, Transportation Building, Montreal.

Mr. H. K. Dutcher Points Out the Power Advantages of the Cheakamus River

Vancouver, B.C., June 13th, 1917.

Editor, Electrical News:

I note in your issue of June 1st an article by my friend Mr. W. R. Bonnycastle, on the Hydro Possibilities of British Columbia, which article gradually leads from the general subject of water powers with more particular emphasis to the merits of the Bridge River power as a project most acceptable to the city of Vancouver in its plans for a municipal power system.

As the city will probably accept the offer of Sir Adam Beck to have the engineers of the Hydro-electric Commission investigate the several water powers submitted to the city, including the Bridge River project, by the Bridge River Power Company, for which Mr. Bonnycastle is consulting engineer, and the Cheakamus River by the B. C. Power and Electric Company, for which company I am consulting engineer, it is naturally assumed that the article in question appears at this opportune time with possibly some prospect of creating in the minds of those interested, a special attachment to the Bridge River scheme in its relation to the requirements of the city of Vancouver.

Therefore, on behalf of my clients, who have given an option to the city for the purchase of the rights of the Cheakamus River, I wish to correct the impression which some of your readers may obtain from Mr. Bonnycastle's article that the Bridge River Power is the most suitable and economical power for the city of Vancouver to purchase and develop for the requirements of a municipal system.

At the time when the Royal Commission were holding session in Vancouver last year I prepared a report for presentation to the Commission on the Water Powers of British Columbia, with more particular reference to the powers available within practical range of Vancouver, this report being submitted at the request of the Vancouver Board of Trade.

I also obtained options on both the Bridge River power and the Cheakamus River power about a year ago, and personally submitted these powers to certain New York groups interested in water powers for special industries depending on cheap electrical power, and in the course of the study of these powers with the engineering experts of the groups interested it was clearly demonstrated that it would be neither practical nor economical to bring the Bridge River power to the Coast to compete with the Cheakamus and other powers more favorably situated.

From the plans submitted there is no evidence that the Bridge River scheme can produce more than 200,000 h.p. of continuous energy from the storage available and shown on the surveys of the company, there being a mean storage area of about 950 acres, giving by a 150 ft. dam, a storage of less than 60,000 acre feet, whereas the government records of stream flow (see page 169, Water Resources Paper No. 14 for 1914) show that this river requires 1,213,000 acre feet storage for the eight months period of low flow to maintain the flow required for 400,000 h.p.

The cost of development at the power plant will apparently be no cheaper than the cost per h.p. of several powers on the Coast, including the Cheakamus and Campbell River schemes, while the transmission to Vancouver, a distance of about 150 miles, would add enormously to the cost of the power to the city, especially for the first forty or fifty years' requirements of the city in competition with the existing systems, and with a capital charge of at least $200 per h.p. for the initial development of 25,000 h.p. required.

The capital cost for developing power from the Bridge River and Cheakamus River schemes is estimated to be about the same per h.p., and Mr. Bonnycastle's estimate for 50,000 h.p. from the Bridge River includes an estimate of $2,580,000 for the transmission system alone, but since the Cheakamus power is only forty-four miles from Vancouver, there is a difference in this case in favor of the Cheakamus power transmitted to the city of at least $1,750,000 capital expenditure, or about $210,000 in annual charges.

Steam Reserve Necessary

The 150 miles of power transmission from the Bridge River through a mountainous country severely affected by winter conditions would make necessary the construction of a steam plant reserve with a capacity probably equal to the development, and this should therefore be added to the capital and annual cost of power from this source.

The Cheakamus River can produce from two power stations a total of about 300,000 h.p. of continuous energy at a cost of less than $70 per h.p., or an annual cost of about $8.50 per h.p., the cost of the first 25,000 h.p. development being nearly as low per h.p. as the full development. The new government maps of the district show a drainage area of about 450 square miles, and the mean flow varies from 2500 to 3000 second feet, as may be noted on page 175 of Report No. 14. The extreme regularity of flow of this river is naturally due to the heavy precipitation common to the Coast, and the numerous glaciers and lakes, including Lake Garibaldi, area 3,380 acres, Cheakamus Lake area, about 2,400 acres, with several smaller lakes on the course of the river.

In the examination of these and other water powers there are several factors affecting the value of water powers in this province which perhaps are not so familiar to the conditions affecting water powers in the East. It is seldom found, for example, that engineers will attempt a large power development in a mountainous district where there are no lakes for storage and where the stream flow is extremely variable, as the construction of a dam for storage under such conditions is attended with more than the ordinary risks and expense, especially in the dry belt under the conditions of limited and only recent records of stream flow.

The additional risks attending a long transmission line through a mountainous country with no market of any value along the route, greatly depreciates the reliability of power and naturally increases the necessity of steam plant reserve.

To properly gauge or estimate the market for power available for a municipal plant in Vancouver, it is well to keep in mind the existence of two companies already in the field having control of several hundred thousand h.p. available with about 120,000 h.p. already in operation.

Under similar conditions of competition the city of Seattle power plant system, after ten years operation has a power load of about 20,000 h.p., and the Winnipeg municipal system a load of about 24,000 h.p., both these cities having a much greater population than Vancouver, while the Ontario Hydro-electric Commission, by their last report, show a peak load of about 95,000 h.p.

It would seem advisable to plan the Vancouver municipal plant system for an initial development of not more than 25,000 h.p. with the assumption that a load of about 50,000 h.p. might be obtained in, say, twenty or thirty years, and the cost of power from the start must be low enough to compete successfully with the existing systems, unless the city wants a white elephant as a burden for the ratepayers to carry in addition to the already burdensome conditions of taxation.

Therefore it is suggested that with 300,000 h.p. available from the Cheakamus River alone with power stations close to the city, it is hardly possible that the city will ignore the Coast powers and go back nearly 150 miles to the dry belt country for the 200,000 h.p.. available from the Bridge River scheme.

These features will doubtless be fully and satisfactorily covered in the report to be submitted to the city, but in the meantime this letter is submitted in the interests of my clients the B. C. Power & Electric Co., and in justice to the merits of the Cheakamus River power possibilities, which apparently is included in the smaller water powers near Vancouver, referred to by Mr. Bonnycastle in his interesting article.

Yours sincerely,
H. K. Dutcher.

Buying a Cause and Paying for Effect—Useful Suggestions on Selling

The Society for Electrical Development has issued a splendid little handbook on selling illumination called "Buying a Cause and Paying for Effect," which, we hope, will find its way into the hands of many Canadian salesmen of electric light equipment. The text of the book is that it is an "effect" we must try to sell—not lamps, or glassware, or fixtures. And, indeed, this conception seems to lie at the root of all successful salesmanship. It is just another word for "service," which, after all, is what the average customer tries to purchase in whatever store he enters, from boots to hats. The actual article is of secondary importance. What it will do for the owner is the prime consideration.

This booklet is full of useful suggestions on how to sell the "effect." They refer chiefly to the sale of illumination, but are equally applicable to other electrical equipment. We quote the following as of special value:

Essentials of Selling Plan

An effort to properly sell better illumination resolves itself into four important stages:

1. Preparation of prospect list.
2. Advertising.
3. Solicitation.
4. Follow-up.

1. Preparation of Prospect List

The prospect list is of first importance. It should include the name of every merchant and manufacturer whose lighting might be improved. As a matter of fact, such a list would include practically every user of electricity. (We purposely omit non-users of electricity, as such prospects would be better covered in a wiring campaign.)

So that sales efforts may be concentrated on those whose lighting is in more obvious need improvement this list should be classified—either by a marker or on the card or by keeping separate files, into those considered immediate prospects and those to be called on at a later date.

The list might also be divided into industrial and commercial classes. Where possible, better results will be obtained if one salesman goes after stores while another specializes on factories, foundries, and other industrial plants.

Many ways of obtaining an accurate prospect list will be found. Some of the "livest" leads are generally obtained by a little night work. A stroll up and down the principal streets in the evening will quickly give you the names of the stores in need of better lighting.

Once started, the prospect list should be kept constantly up to date. An accurate list is invaluable. An inaccurate one is a cause of wasted effort and wasted money.

2. Advertising

Advertising is not an expense if properly handled. Rather it is an investment. It is no more an expense than an active salesman. But to be effective it must have a definite objective. It must pave the way for the salesman's call. It is far cheaper to do a big part of the educational or missionary work by means of the printed salesmen than by means of flesh and blood salesmen. And an advertisement in a newspaper, or a folder, or on the back of a bill will often get to the right man when your crack salesman can't get by the office boy.

So advertising offers you the one best way of preparing the way for your salesman's call.

We will not attempt to say which form of advertising you should use. Use them all if you can—newspaper, circular letter, mailing card, movie slides, back of bills, delivery wagons, bill boards, etc.

Under the heading "Solicitation," which follows, will be found sales arguments, which may be used equally as well in your advertisements.

3. Solicitation

Never lose sight of the one real objective of every salesman—to get the order. And that means to sell the goods or service and to make the sale in such a manner that a pleased customer is added to your list.

To save the salesman for this most important work is to keep the cost of the completed sale down to a minimum.

A salesman is a "closer," and, whether an organization has one or a hundred, this fact should always be kept in mind.

Some Arguments for the Salesman

While no fixed line of argument can be laid down, there are a few points which it will be well to keep in mind.

In the first place, it is important to pick the right line of reasoning at the start.

You will find plenty of merchants who are spending money on their store fronts, on interior arrangements, extensive delivery service, expensive showcases, etc., and yet these same merchants will calmly tell you, "My light bills are too high now. If you will show me how I can cut them I'll talk to you."

You must make this type of man realize that he is positively wasting money on all these improvements if he is not at the same time getting the very best lighting system he can find.

Don't let your prospect get into the "cut-my-lighting-bills" rut.

Let the argument of reduced lighting bills be secondary and be very careful how you use it. You are building on a mighty shaky foundation if you are selling a merchant better light simply because his bills will be lower.

You will have a hard time convincing him you can give him more light and at the same time cut his bills.

If you sell him on that argument his chief concern is going to be to watch his bills. He really doesn't believe you can do it, and wants to prove you can't.

But, on the other hand, if you sell him better lighting, a brighter, more attractive and business-drawing store, with the question of a few cents more or less on his lighting bills left in the background, you have sold him something tangible and something which will stay sold.

Certainly this is about the only way the new Daylight Lamp can be sold. When it was first introduced it practically sold itself. The clothing store manager saw the wonderful daylight effect in the window of the dry goods store. He liked it, and installed "Daylight" in his own store. The question of cost didn't enter. He wanted the best light and he got it.

Sell the merchant on the idea of the importance of good light as an advertisement. There is no advertising outlay that he can make that will yield him the continuous returns that money spent for proper illumination and lighting equipment will.

Light cheers, and the cheerful shopper is a good buyer. Amusement resort proprietors have been quick to realize this fact, and, as a result, they light up their places to the very limit.

In closing these few points, remember that the two vital factors in retailing to-day are location and illumination. No live merchant would consider for a moment cutting down his rent by moving to a side street. And yet he might about as well be on a side street if his lighting is not up to "Main Street" standard. Many a side street has been made into a busy thoroughfare by good illumination, and many a side street merchant is putting more money in his pocket every year because his better lighted store is pulling trade away from his short-sighted rival on "Main Street."

Demonstration Applied to Store Lighting

A convincing method of making merchants whose window lighting is not effective see their store as the "man on the street" sees it has ben worked out by a well-known progressive central station.

A merchant selected in a particular block—one whose lighting is poor—is approached with the offer to fit up his window with a thoroughly up-to-date and efficient equipment of lamps and reflectors. He is told that the installation will be put in on trial, without a cent of expense unless he wants to keep it.

If a store can be found which has two windows, one is equipped with good lighting, the other is left as it is. Forty-nine times out of fifty the contrast between the two windows will decide the merchant to keep the correct equipment, and you will get an order to modernize the other window. As an object lesson an installation of this sort will be a strong factor in selling the adjoining merchants.

But bear this in mind: Just as long as you, who are selling proper illumination, allow a merchant to regard good lighting as simply big electric light bills, just so long will he keep this point of view and continue to try to cut his lighting overhead. It's up to you.

Your aim should be to make the merchant see that an installation of modern illumination will give a tone to his store, will aid in showing off and selling his merchandise, and will please his customers, and lessen mistakes. In other words, hammer home the idea of the attractiveness, utility, economy, [illegible] of adequate illumination.

Many of the above arguments apply also to industrial lighting in shops and factories. You must drive home the fact that better and properly distributed illumination will mean more and better work turned out, fewer accidents, and less spoilage.

These are all big items to the industrial plant manager, and you will find plenty of facts and statistics to back up your arguments.

Selling Lamps Over the Counter

In selling lamps over the counter don't sell a 60-watt or a 25-watt lamp. Sell the illumination the lamps give. Unfortunately, a great many stores still demonstrate a lamp by sticking it into a handy test socket and letting the glare hit the customer in the eye. The theory, apparently, is that the brighter the glare the better the lamp.

This method is all wrong. In the first place, it is to be hoped that a bare lamp is never used for present-day commercial lighting. All the efforts of recent years have been concentrated on increasing the illumination on the object and concealing as far as possible the source of illumination—the lamp filament—from the direct range of vision.

A a far better way to show a customer the illumination to be obtained from the different size lamps is to display each in its proper reflector—in such position that the light will be thrown down on the counter or table. The customer then sees, and pays for the effect while buying the cause.

The ideal way to sell lamps is not to ask the customer what size he wants, but to find out where and under what conditions he is to use them and then sell him the lamps that your experience tells you are the proper ones for the place.

This is real illuminating service. It is selling him the "cause" which will give him the "effect" he is after.

Enlarging Again

The factory of the Main Electric Manufacturing Company, Pittsburgh, has been enlarged again for the fourth time, more than doubling the existing facilities for supplying Main electric plants. It is stated by the company that their field has been greatly widened, varying from export business coming from the remotest corners of the earth, to equipment for home requirements, including factory lighting sets, belted and direct connected, and church and farm sets.

For Liberty

Every member of the Economy Fuse and Manufacturing Company, Chicago (numbering over two hundred), has purchased one or more Liberty Bonds, from the officers and directors to the newest office boy. The total amounted to $80,000. The company evolved a liberal selling plan, based on weekly payments proportioned to the wage or salary of the individual. In some cases the payments are as low as twenty-five cents a week. In addition, the company will pay the last $5 of the purchase price as a bonus to the employee who remains in the company's employment the required length of time. It is provided that where an employee leaves the company before his subscription is entirely paid for, the money paid in will be refunded, together with six per cent. interest.

Brisk Business

Electrical supply houses in Montreal report that business is brisk. This condition is likely to continue as long as the munitions contracts are in force, as a very large volume of orders are for war account. The difficulty is to secure sufficient raw material in order to give prompt shipment of the manufactured articles. In certain lines delivery cannot be promised for several months.

The Dealer and Contractor

A Contractor's Accounting System—Very Few Businesses Know Cost of Operation—Splendid Paper Before Massachusetts Association

By Mr. M. K. Curran

The electrical contractor occupies a unique position in the business world. Consider the development of the electrical industry as a whole, away in the background we have a scientist, and from his mind came forth the invention; this invention was presented to the promoter, who interested the public in granting a franchise and subscribing to the capital stock; then came the engineer and the construction gang, and from their hands came forth the completed plant. The public is greatly interested in this plant because it has had considerable to do with its production and wants to use it. The contractor is the last link in the chain of serving the public with electric power. It is obvious, therefore, gentlemen, that with the community on one side pulling the contractor to connect them up with the current and the manufacturers of power and apparatus on the other side pushing him, the position of the contractor in commerce is assured. The community, therefore, is willing to pay you for your services and does pay you what you say your services are worth. But do you price those services on what they actually cost you or do you base your prices on guess-work, influenced largely by what you think the other fellow will ask?

Cost Accounting

This brings us to one of the most important questions before the business world to-day, that of Cost Accounting. This is of vital importance to the smallest business as well as the greatest. Investigation by the Federal Trade Commission shows that very few businesses apparently know the actual cost of operation. We will admit that without accurate costs we cannot have intelligent competition. None fears intelligent competition. It is the unintelligent—the irresponsible type of competition—that is a menace to the contractor as well as the industry as a whole.

There are several good bookkeeping systems for sale. Of course, you can always call upon accountants to put in bookkeeping systems suitable to any peculiarities of your business. The question isn't only the kind of a system that you use but more how accurately is it followed and what action do you take on what it tells you.

Contractors as a class appear to have the poorest accounting methods of any engaged in business—in many cases little or no accounting. One point has been particularly apparent in almost every case—that overhead expense is not properly determined, nor is such overhead proportionately charged into their estimates. Overhead expense is not only rent, office salaries, light, and so forth. It is almost invariably everything other than merchandise and productive payroll. Most contractors use a flat percentage for determining their overhead and apply that percentage to all jobs regardless of their size. Does this plan commend itself to you, instead of figuring in terms of per cent. figure in terms of dollars, particularly on small jobs? It is apparent that small jobs cost more for estimating, selling, executing, and so forth, in proportion to their size than do the larger jobs. Small contracts probably constitute a considerable share of your total business and may not be paying their way.

Work Badly Laid Out

When contracts are secured the contractor in a number of cases does not properly lay out his work so that it can be done in the shortest possible time, and thereby with a minimum charge for productive payroll and overhead. The trouble here lies generally in not sending complete and proper material to the job. Many delays occur because small parts are not on hand when the wiremen arrive to do their work I recall being in a contractor's office one morning; he was complaining of the difficulty in making a living out of the contracting business. One of his helpers came into the office and said that Billy had sent him back from a job for a dozen one-inch screws. The contractor looked through his bins and shelves for those screws for maybe ten minutes. He then gave the boy ten cents to go over to the hardware store, get them, and take them out to Billy. I considered that a fair example of what ailed his business. We estimated Billy's time and the boy's return carfare, the higher cost of the screws, and his own time, and those screws cost him over twenty-five cents apiece. He admitted these delays were common but had never figured their cost in just that way. It is therefore important that every job be so handled that it is completed in a minimum of time.

The cost of material and the payrolls and incidentals of every job should be cleared through the accounts and applied against each job's own sheet. This not only gives you a grip on the current progress of your business, but gives you a very good check on the accuracy of your estimates. It is comparatively simple to figure the amount of material required for a job; the payroll is a matter of fairly easy estimation, but it is the incidentals and the cost of delays which you may never see in the total that frequently leave or do not leave a profit on that job.

Buy According to Turnout

Some contractors like to buy 10,000 feet of conduit, 20,000 feet of wire, 10 cases of sockets, and so on. Material in these quantities based on the volume of business the contractor is doing will frequently show that it represents a semi-annual turnover. That is, 10,000 feet of conduit may be all he will use in his jobs for six months; the incentive to buying this large quantity of material was an additional 5 per cent. or 10 per cent. trade discount. Some salesman here may disagree, but let me explain further. The result is that by buying in such large quantities and not getting the turnover the contractor's affairs become wedged up very tightly because his capital investment is tied up for longer than it should be. He cannot pay his bills and other difficulties arise. This does not mean either that the contractor should buy daily each day's requirements; that, of course, is impracticable, but there is a reasonable basis which the needs of your business will dictate, and the turnover is a good guide.

Arrange for Prompt Payment

When jobs are completed the contractors do not bill them promptly to their customers. This is due in many cases not only to the fact that the bookkeeping is not kept up to date, but because the terms of sale have not been clearly expressed. Terms of sale are a very important part of any bargain and contractors seem to cover every other part of the transaction but that. It is advisable even with small jobs if they cannot be completed in a comparatively short time, to arrange for two periods of payment, and to bill promptly when enough work has been done to earn these payments. Jobs which can be completed promptly should call for payment on completion or within a stated time thereafter.

There also seems to be the feeling that collections should be handled in an apologetic manner. The contractor is worthy not only of the amount due him, but at the time it is due him. There should be no resistancy or apology about demanding that which is due.

A number of contractors seem to handle all their collections by personal calls and considerable of their time is consumed, so they are paying a large premium for money which could be secured more economically. This time could be applied productively to the business and earn additional income. It is much better to make out a statement at regular intervals, not less than monthly, of the accounts due you and mail them, following them up in a reasonable time by a written request for payment. If this is done systematically you will find that your collections will improve and the accounts will gradually assort themselves into two groups —the ones just due, and those slow and overdue. These overdue accounts can be handled as you think best, by personal call if necessary, but you should find that the accounts requiring personal attention will represent a smaller percentage of your total accounts and not require the same amount of your time as it does in collecting all the accounts by personal call. The collections should be as good—I won't say better, although I'm convinced they will—if you can express to your customers on paper politely but firmly that you want what is due you when it is due.

In small towns where business is done entirely with the people of that town you may not be inclined to use the mails. I think you should; the post office works efficiently and cheaply. Anyway, written bills should be sent promptly to the customer and written requests for payment follow when necessary.

Prompt collections will give you sufficient money to meet your obligations as they mature; that means prompt payment of bills, and the prompt pay has many material advantages, such as cash discounts and others which accrue to the highly desirable customer.

You can keep down your merchandise investment by intelligent buying and prompt billing and your receivables investment by prompt collections, and the result of both will be a faster turnover. These constitute the bulk of the contractor's investment. The final test of the contractor's investment is not the gross profit it makes, but what it earns on its investment. Practically, the earning on your investment depends almost entirely on how often you can turn it over.

Pay Yourself a Salary

Another point which I find in the contractor's business, and it is a serious weakness, is that there is not any systematic control over the withdrawals which the contractor makes for his personal uses. Each contractor should regard himself as an employee of his business and that business should pay him a fair salary and pay it to him regularly. I recall being in a contractor's place one day when his young son came in and asked him for a dollar to buy an express wagon. He went to the till, took out a dollar and gave it to him. I asked him later how that dollar would be accounted for, and he said, "Oh, it doesn't need to be accounted for; what money comes in is mine. What I pay out is theirs. I don't have to acount to myself for what's mine." By such a practice as this a business man will never know how much the business is worth to him and whether or not it is making good, sound progress. All cash received, regardless of the source, should be cleared through the cash book, and all disbursements, no matter for what purpose, should likewise be cleared through the cash book. This practice will permit an analysis at any time of the resources from which the business gets its income, and how that income has been employed.

When the business has earned so that the capital is increased beyond its immediate needs, the contractor then may withdraw funds above his salary for his own personal uses, but these should be taken at regular intervals in the nature of dividends.

Another very good point to aim at is not to mortgage the future earnings of your business. You may have $10,000 in unfilled contracts on hand and feel reasonably sure of, say, $1,000 net. But unfortunately, our expectations are not always realized. A new piano may be bought on the installment plan and an unfavorable turn in business may make these payments a hardship. If these payments can be met out of the amount you are drawing as salary—that is one thing; but it is quite another to add further burdens to a business which may be fighting hard to improve its health.

Sometimes there is a strong temptation to invest some of the earnings in real estate and be bound to a contract requiring payments at fixed intervals. It is well to remember that real estate generally gives a very slow turnover, and the contractor with a growing business had better keep his capital in his business and turn it over faster, thereby making more in the end than he could by a slow real estate investment.

The Contractor as a Dealer

The retailing of electrical supplies, which is now handled to a great extent by the contractor-dealer, requires business capacity of a higher type than the ordinary wiring business. The retail supplies carry a higher rate of profit and the overhead cost can generally be absorbed in the present overhead. It is advisable, however, to separate the accounting on the contracting business from the retail business. I have found businesses where the retail end was supporting the contracting end, and in other cases where the contracting end was supporting the retail end. This was not due to either business not being capable of paying its way, and showing a fair profit, but because the proprietor was inclined more toward one than the other, and really did not know what either paid him, as he had not separated the results. It is likewise advisable where fixtures are manufactured or dealt in largely by the contractor to separate that business also.

Some men seem to feel that they are not properly in business unless they have rather impressive business quarters with fine furniture, show cases, private offices, etc. These are all right enough in their way, but it is well to consider their cost in proportion to the volume of business done and the profit earned. Some contracting businesses have assumed such large obligations of this kind that it virtually amounts to the tail trying to wag the dog.

Another point which is aside from accounting, but I would like to introduce it anyway, is that of salesmanship. The contractor takes a job, we will say for $200 for wiring a residence. The cost of the electrical wiring and fixtures is so small in comparison with the total cost of a house that it virtually amounts to the salt at this fine banquet this evening. Isn't it well to discuss with the owner the plans he has had drawn for the electrical work? You may find so many wall outlets; why isn't it good business to suggest baseboard outlets or floor outlets in the dining room, to connect a coffee percolator, toaster, and other devices; outlets in the bedroom for portable lamps and warming pads, and in the bathroom, and so on? Electricity has a great deal to do with the convenience and appearance of a house; owners are susceptible to arguments of this kind and if you handle the matter properly, not only will the size of your contract be increased, but you will most likely also sell the devices for which these extra outlets are made.

Credit Data

Probably some of the data considered by credit men will be interesting to you gentlemen. The Commercial Agencies assign capital and credit rating; a summary of these ratings assigned to electrical contractors or the absence of ratings indicates that as a class they are doing business on a small margin of capital. You will all agree, I think, that 1916 was one of the greatest business years, if not the greatest, that this country has ever seen, and that the prosperity was widespread. The number of people going into business each year has been increasing faster than the number of people in the country, so that the increasing number of failures it appears is due somewhat to a dilution of business quality. The statistics on failures furnished by Bradstreets for 1916 may be interesting to you. Of the number failing, 97.7 per cent. had moderate or no credit rating, and 5 per cent. employed under $5,000 capital. Those who failed owing under $5,000 were 63.1 per cent. of the number. All these figures are increases over the same classifications for 1915. If the foregoing has interested you it seems to follow that the causes would also. Incompetent is credited with 33.2 per cent. of the number of failures, and lack of capital with 30.3 per cent., or a total of 63½ per cent., compared with 57.3 per cent. in 1915. These figures refer to the business in the country as a whole; there were over 16,000 failures, embracing all lines of commerce.

Business Competence

Incompetence with the electrical contractor is not of the technical kind; you all know your trade, how to wire houses and make the electrical equipment which you furnish operate; but the kind of competence needed is business competence, and that means the broad education which the wireman must acquire to properly hold his place in the business community. That competence embraces the knowledge of costs, accurate estimating, intelligent buying, prompt billing and collecting, paying of bills, and the accounting of the business as a whole. We might add adequate insurance, fire and liability—in fact all those things that make the well-grounded business man.

The Different Factors in Cost

The credit man may have appeared to you as a man maintained solely as a watch dog, and for his barking and biting abilities to worry the money in. That may have been the case a few years ago, but that type of credit man cannot stand in the present business scheme of things. To-day he must be an up-builder, a generative force and not merely a brake. He recognizes that his customers' welfare is his, and that that welfare depends on co-operative action and not on dictatorship. Conservation is the present keynote, but conservation cannot be successful unless it is based on knowledge.

Some businesses have been humorously mentioned at times because of their efforts to ascertain exactly the different factors of cost. Red tape has been the common expression. The investigation by the Federal Trade Commission shows that there is a lack of such knowledge, and we will all, I think, recognize its necessity and see more wisdom than humor in the effort to acquire it.

Conserving Business Men

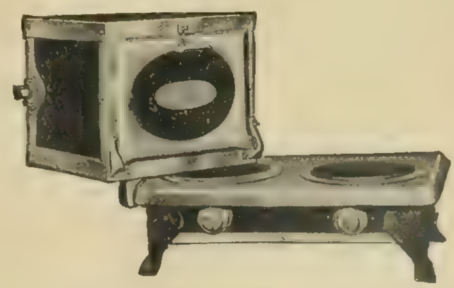
A commercial failure means not only the loss of money to the debtor and his creditors, but the loss of a business man to the community. It is just as important that the human material be conserved as that we conserve the dollars and cents. A successful business man is a rock of strength not only to himself and those dependent upon him, but to his community and the country at large. The credit man of to-day is working hard to keep abreast of the times and equip himself on all business practices. If you will confer with the credit men of your acquaintance I think you will find them broad-minded and anxious of an opportunity to help you.

Handy Auto Push Button

The horn push button on Ford cars is located in a decidedly awkward place—on the steering column. To reach it one must put the arm either through or around the wheel. A device to overcome this inconvenience has been placed on the market by the Francis-Rand Company, and is illustrated herewith. It can be attached in less than five minutes by simply removing the nut at the top of the steering column and replacing with the switch in position. The wire from the existing switch is removed and extended to meet the wire which is furnished with the "Handy" switch.

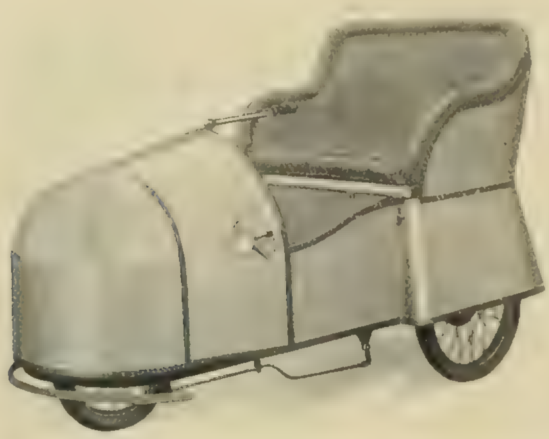
The Kitchenette Electric Range

The electric kitchenette range, illustrated herewith, has been developed by the Standard Electric Stove Company, to meet the requirements of small kitchens. The oven is pivoted at the outside corner so that it will swing over the hot plates and thus not require a separate heating element. There is an open-coil heater in the top of the oven for broiling, toasting, etc. The oven has double walls, which are insulated and lined with aluminium. With both burners operating at full intensity the oven will attain its maximum temperature in four minutes, it is claimed. Each hot plate is controlled by a three-heat multiple switch which regulates the power demand to 1,000, 500 or 250 watts as desired.



An Electric Motor Chair

The electric motor chair, illustrated herewith, has been placed on the market by the Mills Electric Company. The motor is of special design from ½ to 2 h.p., according to load, geared direct to the axle of front wheel at a suitable ratio to drive the car up a 15 per cent. grade carrying two adults. Speed on the level is from 4 to 8 miles per hour. The batteries are of the Standard Vehicle type and are readily replaced. Either 150 ampere hour or 200 ampere hour batteries are furnished, the former giving five hours continuous running and the latter 7 hours. Both batteries are of the 12 volt type. The car is furnished with two head lights and a tail light. A guard is provided in front which cuts off the power and applies the brake on coming into contact with any obstacle. Top and side curtains are also furnished when desired.



Personals

Mr. Frederick S. Viney, late of the Westinghouse, Church, Kerr Company, New York, has taken charge of the electrical department of F. R. J. MacPherson & Co., 176 Simcoe Street, Peterboro, Ont.

Mr. G. H. Stickney has been elected president of the Illuminating Engineering Society. Mr. Stickney is in charge of illuminating engineering in the Harrison works of the General Electric Company.

Mr. H. R. Gerrard, for two and one-half years city electrician at Port Alberni, Vancouver Island, is now filling a similar position at Duncan. Mr. Gerrard served his time in machine shops and electrical plants in England.

Mr. Charles B. Ellis, who until recently was Supply Sales Specialist with the Montreal branch house of the Northern Electric Company, has recently been appointed superintendent of supply sales, Canadian General Electric Company, Limited, Montreal.

Mr. C. U. Peeling has accepted the position of manager of the Stormont Electric Light and Power Company, Ltd., and the Cornwall Street Railway, Light, and Power Company, Ltd., in succession to Mr. William Hodge, resigned. Mr. Peeling was manager of the gas and electric properties at Oshawa, Ont., for some years, formerly for the Electric Power Company, Ltd., and latterly for the Hydro-Electric Power Commission of Ontario.

Trade Publications

Electric Fixtures and Glassware—Catalogue No. 6, by the Galt Electric and Gas Fixture Company, Galt, Ont., designers and manufacturers of high-grade electric fixtures. This is a beautifully illustrated catalogue, showing a variety of the latest designs and styles of lighting fixtures for all classes of buildings, including a large line of semi-indirect bowls and candelabra designs for residences. This company also carry a full line of electrical supplies.

Stokers—Bulletin B-2, by the Combustion Engineering Corporation, New York, completely illustrating and describing their Type E underfeed stoker.

Glassware—Catalogue No. 81, by the Macbeth-Evans Glass Company, illustrating and describing "Decora" glassware; 40 pages handsomely printed in colors.

Electric Arc Welding—Catalog No. 104, by the Lincoln Electric Company, completely illustrating and describing the Lincoln arc welder and the many uses to which it may be put.

Crocker-Wheeler—Bulletin No. 117, issued under date April, 1917, describing form W, rolling-mill motors, 220 or 230 volts D.C., sizes 6½ to 200 h.p.; also Bulletin 178, under same date, entitled "Three-wire Distribution." Both pamphlets are illustrated.

Good Lighting—Bulletin issued by the National X-Ray Reflector Company, entitled "How to Know and Have Good Lighting." This booklet is splendidly illustrated, and contains a quantity of useful technical information regarding the use of indirect lighting units.

C. G. E. Publications—Bulletin No. 42014, Headlights and Turbo-Generators for Steam Locomotives; bulletin No. 46209, Thomson Direct Current Astatic Watthour Meters; bulletin No. 48710, Auxiliary Apparatus for Electric Furnaces; bulletin No. 48609, Centrifugal Compressors; bulletin No. 46028, Temperature Indicator; bulletin No. 46029, High Capacity Portable Wattmeter; bulletin No. 47503, Circuit Breakers; several leaflets on apparatus, including remote control switches, safety-first starters, charging outfits and G. E. compensators.

Air Compressors.—Bulletin K-302, illustrating a line of steam-driven, straight line, single stage air compressors manufactured by the Canadian Ingersoll-Rand Company, Limited, of Montreal. The type of machine described is designed to cover the field of those requiring compact, self-contained units of small and medium size for service in shop, foundry, mill or electrical plant, etc. Automatic splash lubrication, dust-proof construction, "Circo" silent leaf valves and quick convertibility to belt drive are among the leading features of the design dwelt upon in this publication.

Automobile Lens—Bulletin No. 109, by the MacBeth Evans Glass Company, describing a new lens for use in automobile headlights. This lens is distinguished by an enamelled green visor, the primary object of which is to re-direct any upward rays of light. The front surface is divided into five horizontal prisms, which incline at such an angle that the path of the car is lighted to the greatest possible distance without having the glare of the lamps blind the driver in an approaching car. An additional advantage is that part of the rays are directed sideways, thus providing very necessary sidelight.

Electric Fixtures—Supplement to Catalogue No. 5, by the Tallman Brass and Metal Company, Hamilton. This is a beautifully illustrated catalogue, containing some 85 pages of designs representing the latest in Tallman workmanship. This catalogue contains, of course, only a part of the line manufactured by this company, who are constantly adding new designs. Among others there are a number of illustrations of "Aurora" fixtures, which are being manufactured to meet the demand for fixtures combining the appearance and durability of brass, but at a very much lower price. Brass, steel and a special composition metal are used in their manufacture, and the finish is claimed to be lasting.

Toronto Hydro Electric

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Here is strong endorsement of the quality and serviceability of Phillips heavy duty cable. The Toronto Hydro Electric System recently sent us a repeat order for the supply and installation of 8 miles of 250,000 C.M., 3-core, 13,200 v. cable, illustrated above. After installing miles of our product and giving it a most thorough testing in actual use, this re-order is conclusive evidence of the opinion of "T.H.E." experts. Phillips Cable will give you the best of service for power, telephone, lighting, railway or special use.

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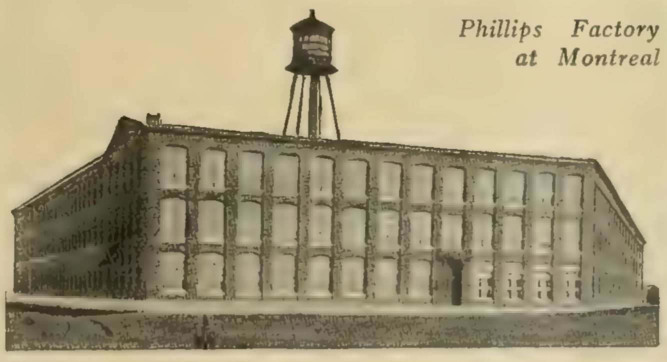

Phillips Factory at Montreal.

Current News and Notes

Carleton Place, Ont.

The Town Council of Carleton Place, Ont., have requested estimates from the Hydro-Electric Commission of Ontario on the cost per horse-power for supplying service to their town.

Fernie, B.C.

The coal mines in the vicinity of Fernie, B.C., are considering the feasibility of installing electric lighting systems, to be used in place of the existing oil lamps. It is anticipated that the present explosion hazard will be greatly reduced.

Granby, Que.

The ratepayers of the town of Granby, Que., have ratified the contract entered into by the council with the Southern Canada Power Company, for a supply of light and power covering ten years.

Hamilton, Ont.

The Bell Telephone Company, it is announced, will proceed immediately with a new $46,000 exchange building on Garfield Avenue, Hamilton, for the purpose of relieving the pressure on the main exchange.

Markham, Ont.

Negotiations are under way to extend the transmission line of the Hydro-Electric Power Commission of Ontario from Agincourt to Markham, Ont. It is estimated that it will be necessary for two farmers in every mile to contract for a certain amount of power, in addition to the supply that will be used in the towns and villages, if the scheme is to be a commercial success.

Montreal, P.Q.

Mr. Lawford Grant, managing director of the Eugene F. Phillips Electrical Works, Ltd., Montreal, has been on a visit to Winnipeg, attending the annual meeting of the Canadian Manufacturers' Association.

J. M. Robertson, Limited, consulting engineers, have removed from 101 Board of Trade Building to 625 Coristine Building, Montreal.

North Bay, Ont.

Lendrem M. Ferguson, inspector of telephones and telegraphs on the T. and N. O. Railway, was accidentally electrocuted at Boston Creek by coming in contact with a high-tension power line of the Cobalt Power Company.

Rosthern, Sask.

The ratepayers of Rosthern, Sask., recently voted on the question of installing an electric lighting system in the town. The proposal carried by an overwhelming majority.

Sarnia, Ont.

The hydro-electric commission of Sarnia announce that the sale of power for manufacturing and domestic purposes from June 1, 1916, to June 1, 1917, has increased over 100 per cent.

St. John, N.B.

The power for Chatham's town lighting system is supplied by a new 200 horse-power Fairbanks-Morse oil engine driving a 150-horse-power generator. A second engine of like capacity is to be added.

Toronto, Ont.

The Toronto Hydro-electric System has applied to the board of control for a further grant of $720,000 to be expended on extensions during 1917. This amount is principally in connection with extensions to the Ashbridge's Bay munition plants.

Vancouver, B.C.

The April gross earnings of the B. C. E. R. Company, just announced, amounted to $447,429; net $97,088. The net for the ten months, July 1, 1916, to April 30, 1917, amounted to $569,407, compared with $334,554 in the previous corresponding period.

The B. C. Telephone Company, Vancouver, are arranging to complete a new central exchange with an ultimate capacity of 30,000 lines. The steel framework for this nine-storey building has been standing since the outbreak of war.

The British Columbia Telephone Company have closed a contract with Messrs. Adkinson & Dill for the completion of the steel framework of their building on Seymour Street, Vancouver, which has been standing in an unfinished state since shortly after the outbreak of war. It is intended to use the building when completed for the central exchange. In it also will be located the contract and recording and other business departments and the offices of the various departmental officials of the company. The plans call for a nine-storey structure. The front of the building, for the first two or three storeys, will be finished with native granite, and the balance with Roman pressed brick. On other portions of the structure pressed brick and enamelled brick will be used, while the top storey will be covered with terra cotta. On the roof a garden will be laid out for the benefit of the employees. The main interior, entrance court, and chief offices will be finished with oak and marble. Construction is to be recommenced at once. The cost of erection already amounts to $75,000, and another $90,000 will be required. The steel framework has been protected during its three years' exposure by a weather-resisting coating.

Wellington, Ont.

In the event of Hydro power being introduced into Prince Edward County it is anticipated that the village of Wellington, Ont., will take 75 h.p.

Winnipeg, Man.

The City Council of Winnipeg, Man., have appointed Van Horenbeeck & Young, St. Boniface, Man., general contractors for an addition to the power plant at Lac du Bonnet. Estimated cost of the work is $185,370.

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Don't Growl—Kick

James H. Collins had an article in a recent issue of McClure's, entitled "Don't Growl—Kick!" If it were not so awfully true it would be almost funny. Here's a sample:

"Talk with anybody in the management of a public service corporation, a railroad company, a city department, or any other institution that serves the public, and you will find that the average American will growl, but he seldom complains. When something goes wrong with the complex routine of our daily life he will argue the matter with a ticket-seller, or a meter-reader, or a city employe. They have no authority to set things right. But he will not go to the trouble of sending an orderly complaint to officials, with names, dates, facts. Sometimes he holds his anger long enough to write to the newspapers.

"The average American uses the newspapers about as a malicious small boy uses his mother in getting even with his brothers. He tattles to them. If something goes wrong he tells the editor about it, relieving his feelings by vague scolding. His letter gives no names, dates, or facts upon which anybody anxious to set matters right could act. To make the letter more intangible he signs himself—Indignant Taxpayer! There is a vague notion in his mind that he has somehow brought the whole affair into the court of public opinion and that public opinion will now take care of it. His letter is about like the bushman's prayer to some evil god to please make life very uncomfortable for some other bushman."

Results of "Wire-Your-Home-Time" Campaign

The winning figures in the "wire your-home time" contest, for which prizes were given by the Society for Electrical Development, seem to indicate that there is still a very large amount of business available in this direction. The number of houses wired in the different classes, too, may be some indication of the most fruitful source of this business. Of course, the individuality of the prize winner was a very important factor, but it is noticeable that the largest amount of business was done in the average size city.

Class A refers to cities of less than 15,000 inhabitants, and the winner wired 119 houses during the six weeks' campaign, with 39,270 connected watts. The winner in Class B—cities from 15,000 to 50,000—wired 109 houses, with a load of 35,425 watts. In Class C—cities from 50,000 to 100,000—147 houses were wired, representing the greatest number; the connected load in this case was 117,600 watts. In Class D—representing cities from 100,000 to 500,000—the number of houses wired was 116, with a connected load of 42,010. Class E included cities over 500,000; the winner in this class wired 110 houses, but his load of 130,700 watts was the record for the contest.

There were 37 prize winners, representing in all 2,663 houses wired—that is, an average of 72 houses each, or 12 per week. Altogether there were over 10,000 houses wired.

Hamilton Section C.E.A.

The Hamilton section of the C.E.A. met on Monday, June 25. The meeting came to order at 8.15 p.m., with C. H. Fry in the chair, about 35 ladies and 45 men being present. The minutes of the previous general and executive meetings were read and approved. A very attractive program was furnished, as follows: Violin, Mr. Kingan; solo, Miss Grace Miller; duet, Misses Miller and Davidson; solo, Miss B. Tovell; solo, Miss Grace Miller. Refreshments were also provided by the ladies.

Mr. W. H. Smye, the retiring secretary, was the recipient of a handsome military souvenir, in recognition of his past services. Mr. Stewart made the presentation. There was great applause. Mr. Smye replied in a few well-chosen remarks.

It was moved by F. B. Griffith, seconded by W. E. Goring, that the ladies be invited to the annual picnic. Carried.

Choice of a place for the picnic was put to a vote, with the following result: Brantford, 1; Grimsby, 7; Oakville, about 70.

The following men were elected to act with the executive committee to complete the arrangements for the picnic: C. G. Choate, chairman sports committee; G. N. Kendall, chairman prize committee; L. V. Blatz, grounds and refreshment committee. These gentlemen were given power to add to their numbers.

Talks were given by Messrs. E. P. Coleman, W. A. Sweet, and L. W. Pratt.

Nitrogen from the Air

The National Efficiency Board has invited Mr. J. Orchiston, chief electrical engineer to the Post and Telegraph Department, to report on his proposal for establishing an industry in New Zealand for producing nitrates from the air. Mr. Orchiston has acquired data dealing with the cost of hydroelectric schemes in Germany, Norway, and Italy, and in no case, he said, can electricity be generated as cheaply as it could be done by utilizing any of the large falls in the southwestern sounds of New Zealand. One of the simplest propositions is that presented in utilizing the Bowen Falls, in the Milford Sound. He estimates that, after making full allowances for all contingencies, energy could be produced for one [illegible] part of a penny per unit, or one horse power at a cost of $5 per annum. For nitrogen fixing from the air, Mr Orchiston doubts if there is a more favored spot in the world, for at the Bowen Falls there is deep water close to the side of the sound, and perfect shelter in all kinds of weather.—Auckland Weekly News.

Power for Montreal City

Controller Cote, of Montreal, will ask the Board to adopt Plan No. 2, recommended by Messrs. H. E. Vautelet, A. St. Laurent, and J. B. McRae, who recently reported on the Montreal aqueduct and the proposed hydro-electric development. This plan is for the maximum hydraulic development, estimated to give 13,000 h.p. in winter and 24,500 h.p. in summer. The engineers estimate for a development of 13,000 h.p. summer and winter, 8,750 being required for pumping and 1,910 for filtration, with an excess of 2,520. This will have to be supplemented by an auxiliary steam plant. The total capital cost is $10,609,000, and the cost of operation $740,000. None of the schemes considered give enough power for electric lighting. Controller Cote states that the power companies will be asked to give quotations for a supply of power for pumping purposes for long periods, and if this cost is less than the city can supply it, it is proposed to enter into contracts. In the meanwhile the Council will be asked to give authority for the preparation of plans for an electric motor driven pumping station, the engineers having reported that the equipment of the station will be the same whether the city generates its own power or buys it.

Recent Developments in Electric Truck Service

By A. Jackson Marshall*

The Commonwealth Edison Company of Chicago announces an epoch-making plan for the promotion and use of electric commercial trucks. Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company, is authority for the announcement:

"After investigating carefully the cost of operating electric trucks in Chicago, the Commonwealth Edison Company has decided to offer to the public a complete garage and maintenance service for commercial electric vehicles at specific rates per annum on long term contracts. This service will be so comprehensive as to cover all the doubtful elements of transportation expense, and will thus enable any customer to determine in advance just what it will cost him per year to operate any size fleet of electric trucks.

"Furthermore, since it is a well-known fact that wherever electric trucks are intelligently applied in superseding horse-truck service there is considerable reduction of operating expense below the horse-truck cost, the contract made between the Commonwealth Edison Company and the truck users will therefore serve as an assurance of this cost reduction, because it covers all the unknown quantities, and the remaining factors in the expense are only those concerned with fixed charges, insurance, and drivers' wages, all of which are known quantities, and hence the total cost can be definitely settled in advance for a period of years.

"The proposed service will naturally first cover the ordinary garaging or storage, including the cleaning and care of vehicles. Secondly, it will include the supply of energy for charging the battery, and in the third place it will provide for the maintenance or upkeep of the wearing parts of the vehicle, including tires, battery and mechanical parts.

"This maintenance will cover minor repairs of all kinds, as well as the renewal of tires and battery when worn out. It will also include painting of the body at specified intervals, and provide for retouching and varnishing at intermediate times.

"Such service will obviously relieve the customer of administrative expense and the cost of supervision, both direct and indirect, which he would have to bear if he operated the vehicles in his own garage. It must be understood that the owner pays the drivers' wages, insurance, and the cost of damage by accidents.

"New trucks only will be accepted for the service. The rate for each size, equipped with standard battery, will be a flat figure per annum payable monthly in twelve equal parts. Trucks equipped with batteries of sizes larger than the standard will be charged for at proportionally higher rates. The working radius of the truck which the flat rate is intended to cover is that amount of service which can be procured from one charge of the battery daily. If the work to be done by the user should be greater than this and such as to require additional charging during the day, or the use of extra batteries, the flat rate above mentioned will be increased accordingly. Thus the whole system, while based on a flat rate for minimum service, is really a measured-service scheme depending upon the requirements of the user. As the service proposed will provide for renewal of battery, tires, and mechanical parts when they wear out, the customers' vehicle will be practically as good as new at the end of the contract period, except for such depreciation as may have taken place in the non-wearing parts.

"The company is having a large service station erected at the corner of Jackson Boulevard and Morgan Street, a location which is very close to the trucking centre just west of the main business or "loop" district. This building, which should be ready for use by the end of the summer, will render service to one hundred electric trucks. Should this space be taken up quickly, additional space will be provided in the same neighborhood for a further trial of the proposed service.

"The company is also planning to establish other service stations as the project develops, beginning with one on the north side and one on the south side of the loop district, if the first undertaking demonstrates a satisfactory demand for this type of service.

"The company will employ a specially qualified staff for the development and conduct of this service. Salesmen, supplemented by transportation engineering service, will be able to present to prospective customers having large horse-truck equipments facts and figures which will completely satisfy them as to their present expense, and will subsequently present statements which will prove the reduced expense to be effected by substituting electric trucks for these horse equipments.

"Already considerable research work has been done to determine the size, location and other characteristics concerning the principal horse-truck equipments now in Chicago, and by conducting an extensive campaign in showing the truck owners local to this service station the annual value to them of the service to be rendered, the company will automatically develop such horse owners to the point where they will be ready to purchase electric trucks from the manufacturers of these vehicles.

"This undertaking is the broadest of its kind, and is intended to eliminate the difficulties experienced in other partial service systems, since the plan covers by one contract for a term of years the complete maintenance costs of the equipment used, a proposition which electric truck owners have never had offered to them before this undertaking."

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* Secretary Electric Vehicle Section N.E.L.A.

The Electric Taxicab

The most recent installation of electric taxicabs, which have met with phenomenal success in Detroit, is in St. Louis, where six cars make up the nucleus of a fleet. The clean, silent, smooth running attractive electric taxicab has made a strong and immediate appeal, and has proven itself to be extremely well fitted for this service, especially because of its low operating cost, and its simplicity of operation through congested streets, insuring safety to its occupants. The mileage of these "electrics" is practically unlimited, as facilities for curb "boosting" are situated in various parts of the city, so that the cab may be charged while it is waiting, even though it may be only a few minutes

It is stated that an electric taxicab company is now being organized in Mexico City, and it is interesting to note that whereas the electric taxicab met its first success in Detroit, the home of the gasoline car, it is now to compete with the gas car in the habitat of hundreds of oil wells. It is also found in successful operation in Shanghai, China, where it has to a great extent replaced the quaint and quite inexpensive jinrickshaw.

Progress is being made in the matter of the initial fleet of about 500 electric taxicabs of the most advanced type, which it is intended to install in New York City, and which will provide a service of a distinctly revolutionary character.

Chicago Garage Offers Battery Rental Plan for New Electric Passenger Cars

The Fashion Automobile Station, Inc., of Chicago, Illinois, which is also an agency for electric automobiles, has developed a battery rental and exchange plan in connection with the sale of new cars.

Under this plan the new "electric" minus the battery is sold for $1,485. The battery for the car is then rented for $15 per month plus $1 per battery charge. The cars are equipped with a specially designed battery rack so that the battery may be changed in two and five-tenths minutes, or in less time than it takes to fill a gasoline tank. Changes can be made at any of the five stations strategically located in Chicago and its suburbs.

This plan supplies the user with unlimited mileage from a standard battery, it relieves him of investment in a battery; it assures him that his battery will always be under expert care, and, if he is out of the city, it permits him to eliminate battery costs and depreciation during periods longer than one month.

It is stated that this method saves the customer about twenty per cent. on his original investment and relieves "electric" driving of all uncertainty; a similar plan with electric trucks has been used successfully in Hartford, Connecticut for over three years.

Efficiency of Cooking Apparatus

Interesting figures on the relative efficiency of cooking pots (fireless cookers), cooking plates and rapid heaters (presumably open coil heaters), are given in a report of investigations printed in a recent issue of the Electrician. The figure herewith illustrates the distribution of the heat energy during the cooking operation in a cooking pot. A table is also given showing the relative efficiencies of the three types of equipment—the open heater, naturally, being the most efficient. The following is extracted from the report:

Complaint is often made of the form of cooking pots, as being inconvenient to clean. It is better to give the vessel straight inner walls (without bends), even though, with side heating, this will make the vessel thicker at the bottom than the top. As regards material for cooking pots, aluminium has the desirable strength, and is a good heat conductor, but is too easily dented. Owing to the present shortage of metals aluminium vessels strengthened with an outer covering of white metal have been used. With the return of normal conditions one would, wherever possible, use the best materials, nickeled brass or, preferably, pure nickel. The latter is certainly dearer, but pays in the long run.

The relative advantages of cooking pots and cooking plates have been much discussed. The latter are decidedly preferable in the completely equipped electric kitchen. Theoretically the efficiency of the cooking pot may be 20 to 30 per cent. higher than an apparatus with outside heating arrangements, but in practice this advantage is less evident. There are also practical advantages in the cooking plate as regards convenience of cleaning and adaptability.

Efficiency of Cooking Apparatus

Investigations have been undertaken on the efficiency of various cooking appliances. The electrical consumption is easily measured direct. The useful efficiency, in terms of the results secured, is more difficult to determine. In the case of vessels used for heating water the estimate of the heat usefully employed can be readily made, but in the case of vessels, frying pans, etc., used for raising more or less solid food to a high temperature it is less easy. With a view to approaching as nearly as possible to practical conditions a metal body, which, after the usual preliminary warming could be placed in position and raised to the desired cooking temperature, has been employed in some cases. It must also be remarked that the efficiency measured depends on such factors as the temperature of the room, the proportion of space in the heating vessel filled, and the amount of preliminary warming given. These conditions may cause variations as high as 10 per cent.

In Fig. 1 the typical processes in a cooking pot are portrayed, the observed quantities being plotted as ordinates and time in minutes as abscissae. The temperature rise is for a time almost rectilinear until the boiling point is reached. The useful power, which is proportional to the rate of rise of temperature, increases sharply from zero and then becomes approximately constant, diminishing, however, slightly afterwards, until the boiling point is reached. The total useful energy is indicated in the shaded diagram as Wn, the energy stored in the vessel by the area as Wc, and the energy given to the outside air by the area as Wa. These three quantities add up to give the total energy given to the vessel.

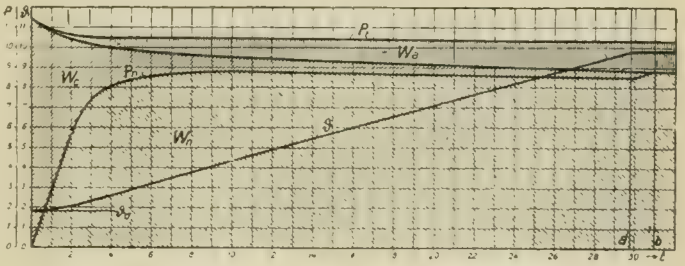

Fig. 1.—Cooking Pot, 5 Litres Capacity, ¾ Full, Enclosed, 105 V.

(a) Water begins to boil. (b) Water boils en masse.

Scale of time, 1 division = 1 min. Scale of power 1 division = 85.5 watts

„ temp. 1 „ = 10 C „ energy, 1 division = 1.227 WE

P_t : Power supplied to apparatus. W_a : Energy lost to surroundings. W_n : Energy usefully applied.

P_n : Power usefully applied. W_c : Energy stored in apparatus. ϑ : Temperature of water.

The efficiency at any moment is obtained by the ratio between the useful power ordinates and the total power ordinates. It has been customary to quote only the maximum efficiency attained when conditions of heat equilibrium are arrived at. Strictly this would only apply to a case in which an appliance was being continuously used for cooking. In practice one has to deal with successive periods during which the vessel is first heated up, used for a time, and then emptied again. It is useful, therefore, in comparing appliances to compare the energy usefully applied, with the total energy given to the appliance during the entire process of heating up. This total energy efficiency is naturally considerably lower than the corresponding efficiency for continuous cooking, on account of the heat capacity of the apparatus. In judging cooking apparatus both forms of efficiency should be stated.

The following table summarizes the distribution of energy as required by cooking pots and plates and as applied also to a third class of apparatus—namely, rapid heaters:—

Distribution of Electric Energy Given to Apparatus (100 per cent.) up to Boiling Point

	Rapid heaters Per cent.	Cooking pots Per cent.	Cooking plates Per cent.
Useful energy received by material cooked	87.0	77.7	63.5
Energy accumulated in apparatus	8.0	11.5	29.0
Energy lost to surroundings ...	5.0	10.8	7.5
Mean consumption, watts	810	895	1,047
Mean efficiency up to boiling point	87.0	77.7	63.5
Max. efficiency in the course of heating	92.0	84.0	...
Efficiency during boiling	89.7	84.3	82.3

In the course of tests rapid heaters were found to have a working efficiency of 78 to 87 per cent., and an efficiency by continuous cooking of 85 to 90 per cent.; cooking pots, 70 to 81 per cent. and 80 to 89 per cent. respectively; and cooking plates, 40 to 65 per cent. and 70 to 80 per cent. respectively. The conduction losses of cooking plates are naturally greater than for cooking pots, on account of the large surface presented. In the case of frying pans the efficiency cannot be easily stated with precision on account of the variation in the period of cooking, the necessity for preliminary heating and other complexities. There is little scope for diminution in the heat capacity of cooking vessels, as their mass has been reduced to the limit consistent with solidity and the material must be selected to meet various other supplementary considerations. In the case of rapid heaters and cooking pots, there also seems little opportunity for diminishing conduction losses. In the case of cooking plates, and in some case frying pans, heat insulation of the sides might be worth while.

It is evident that the efficiency of irons is dependent simply on their temperature, and values have been recorded ranging from 90 per cent., with an average temperature of 120 degs. to 73.5 per cent. with a temperature of 200 degs.

The high momentary current taken by the cold resistance is worth consideration when it is recalled that in a house using a maximum load of only 250 to 350 watts for lighting, might require 2,000 to 3,000 watts for a completely equipped kitchen. In most cases it is not practicable to diminish greatly this initial load, but something might be done by the encouragement of the use of economy-cookers, to processes which require long heating. Heaters for roasting and baking processes are the worst in this respect, and attention might be directed to possible methods of reducing the consumption in these processes.

Modern Automatic Telegraph Printers

With Special Reference to the Western Union Quadruplex-Duplex and the Morkrum System

By Mr. H. McConkey*

Apparently the two most successful automatic printers in use to-day in America are the Western Union Quadruplex-Duplex Telegraph Printing System, manufactured by the Western Electric Company, at Hawthorne, Ill., and the Morkrum Duplex Telegraph Printers manufactured by the Morkrum Company, 24 West Austin Avenue, Chicago.

A careful study by the management of these two companies and by engineers of accomplished high speed telegraphy showed that something would require to be done in the way of improving existing methods to keep pace with modern requirements. To the telegraph engineers of the Western Electric Company and the Western Union Telegraph Company, likewise the other telegraph companies, and the Morkrum engineers falls the credit and satisfaction of developing the quadruplex-duplex system and the Morkrum system respectively, whereby in the first instance eight messages can be sent over one wire simultaneously and in the latter, so far as I am aware, two messages can be sent over one wire simultaneously.

The Quadruple-Duplex System

In the Western Union arrangement, three very important pieces of machinery are the motor and its mechanical corrector, directly connected to the distributor with which there is arranged a motor driving rotating brushes on the stationary commutator distributor. This latter motor is arranged with a tuning fork in order to keep it running at a uniform rate of speed. This with the transmitter and receiving apparatus coupled with their various devices to cover sequence are practically the entire apparatus necessary for one office set, and, of course, the first named parts of machinery covers the range necessary for the additional circuits that are capable of being developed.

One fundamental issue required with "printers" is that a signal code has to be adopted whereby the lengths of signals must be all of the same duration for each letter or character. In regard to the Western Electric Western Union printer each character signal is composed of five units, each unit being either a positive or negative electrical impulse, according to their arrangement. The letter A in the printing code is composed of two positive and three negative units. A study of the code will show that the letter O has the same number of negative and positive impulses as the letter A, but that they are reversed. The transmission of a message by this system requires the following sequence: the tape is prepared on an electrically controlled keyboard perforator, then passed through a transmitter which, working in conjunction with a distributor sends certain impulses over the line. These impulses reach a relay at the other end of the line, which, working in conjunction with another distributor, forwards these impulses to the receiving "printer" which translates them and prints the letters forming a message. The various steps employed are very similar to the arrangement of a pianola.

Attached I have included the printing code this concern have adopted, as it is one of the important features to be considered. Fig. 1.

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* Supt. Electric Power and Telegraph Maintenance C. N. Ry. Extracted from paper before the Electrical Section, C.S.C.E., Winnipeg

The Distributor

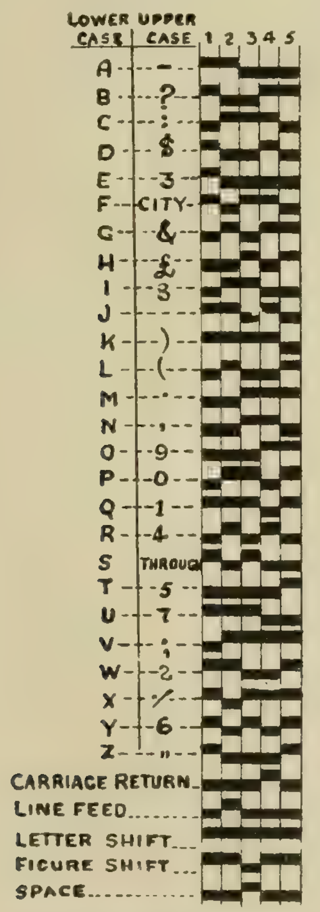
The distributor is built with a certain number of rings divided into quadrants which are acted upon by rotating contact brushes driven by a special motor acted upon by a tuning fork to keep operation at uniform speed. The distributor driven by its motor has a mechanical corrector between the two, and the mechanism is operated by an electromagnet. The object of this is to synchronize the corresponding contact brushes. The motor driving the brush at one end is arranged to run slightly faster than the motor driving the brushes at the other end, and the automatic contrivance operates so as to set back the brush at the fast end. Therefore, by intermittently stepping back the brush at the fast end, the brushes are maintained in proper relation.

Perforator and Keyboard

The perforator and keyboard is similar to a typewriter. When the key is depressed there is a selection of punches which perforate the proper combination of holes and provided with an indicator and pilot lamp to show when the end of a line is approached.

The Printer

The printer contains relays, resistances, etc., for proper operation, and has two keys which on being depressed will cause the carriage to return or the paper to be moved upward. With this system the paper moves and the type wheel is stationary, except that it revolves in order to bring the letter opposite the paper. The type wheel is mounted on a vertical shaft driven by a spring which is kept at proper tension by a small motor. When the letter is selected the type shaft is released and revolved until it strikes a stop, the position of which is determined by the signal sent, then the paper is forced against the type wheel by a magnet and the letter is printed. At this juncture it returns to normal position ready for the next operation.



WESTERN UNION PRINTING TELEGRAPH CODE.

Fig. 1.

Four Messages in One Direction

I will endeavor to explain briefly quadruple operation, or four messages in one direction. Taking into consideration two offices, suppose that one metal ring is divided into quadrants at each point and their contact brushes rotating over the surface of these rings, and that they are connected to the opposite ends of a telegraph line. If the brushes start from the same point and rotate exactly at the same speed and remain constantly in parallel, each quadrant will be connected to the corresponding quadrant at the other station once for every revolution of the contact brushes. The duration of this connection would be one-quarter of a revolution. Now if each quadrant were divided into five segments and each represent a signalling unit, it would be possible to send five signalling units or one complete letter signal to the distant office for every revolution of the contact brushes.

Each unit segment of the quadrant divided is connected to a lever and engages two contact points, one of which is grounded while the other is connected to a source of electric current through a relay to the corresponding unit segment at the opposite station. Likewise if any combination of the five levers connected to the quadrant at the other station is similarly operated, current will pass through corresponding relays.

The operation of a combination of these relays determines the letter to be printed in connection with the type apparatus of the receivers. The selection of the letter takes place while the brush is passing over this quadrant, and while the brush is passing over the other three quadrants the printer has time to print the letter, the carriage will move forward and in time for another signal, while the tape at the opposite station transmitter has time to step forward and arrange for the necessary combination of levers in order to forward the signals for the next letter.

I may state that there are many details which could be enumerated which might help towards a more thorough understanding of the general principles of operation, and the attention required, also a description of duplex operation, but in order to do so a very lengthy description would be necessary.

The Morkrum Printing Telegraph

The Western Union Muliplex printer is not in use in Western Canada, therefore I am unable to show you the apparatus, but we have before us to-night a section of the Morkrum printing telegraph as in use by the Canadian Pacific Telegraphs and the Great North Western Telegraph Company west of Lake Superior.

In a former paragraph I mentioned the Morkrum "printer," and may state that the company I represent has many circuits in operation with this modern and ingenious apparatus. The circuits in operation west of the Great Lakes are from Winnipeg to Chicago, also to Minneapolis and Saskatoon, and in the East from Toronto to Montreal, and also to Ottawa, Buffalo, Chicago and New York. In regard to distances operated over you will notice that in some cases they appear rather long, but consideration has to be taken of the class of wire used, the gauge and insulation, which in nearly every instance is a No. 8 or No. 9 copper wire supported on double petticoat glass insulators of the standard type specified by telegraph engineers. In any case, where the resistance exceeds a certain amount, repeating apparatus is inserted at some point where proper attendance can be given.

I believe one of the longest circuits in operation is located between Winnipeg and Saskatoon. It consists of a No. 6 Birmingham wire gauge wire practically five hundred and fifteen miles long, from which excellent results are obtained.

There are some features of this apparatus closely identified with the equipment formerly under review. The equipment we have here is for duplex operation, but from a perspective view, if not already nearing completion, the Morkrum apparatus will have a manifold treble or quadruple duty to perform in order to keep pace with all competitors and serve a need which is becoming very apparent through increasing telegraph business and a lack of competent Morse manual operators. The paramount necessity, of course, is augmenting the capacity of present circuits on existing lines in order to obviate as far as possible and to hold in abeyance capital expenditure on account of the erection of additional circuits.

The apparatus necessary to perform the capacity of the plants I have seen in operation is less than in the former system, but this is due to the lesser capacity and no doubt would have to be increased for a greater amount of circuits.

Two Systems Alike in Many Respects

I mentioned formerly that in many respects they were somewhat alike in order to obtain results. To this extent there is used a tape perforator, transmitter with the necessary motor control, receiving printer and motor generator for a supply of power, which, of course, is essential in either system in order to obtain current values of constant proportions and to avoid fluctuations.

In this system a perforated tape is used prepared on a keyboard perforator, and a line of holes on the centre which is for the purpose of feeding the tape in the transmitter. The arrangement of the five rows of holes controls the polarity of the five selective impulses which are sent out on the line for every complete signal covering a letter or figure to the distant station. Resting on the tape are five contact pins which operate relay pole changers when connection is made through the perforations and these contact pins are connected to the transmitter discs. The position of the relays will determine whether a positive or negative impulse of the local battery will be connected to the transmitter discs.

When the transmitter brush revolves it will send through the coils of a main line pole changer a series of impulses the polarity of which is determined by the relay pole changers which, of course, is governed by the openings in the tape.

In addition to the selective signals sent out from the transmitter there are two synchronizing pulses connected permanently to the positive and negative of the local battery. By this method the polarity of the impulses will actuate whichever armature of the pole changer is to be moved and the proper polarity sent to the line.

Five Lock Relays

Now at the receiving station there will be required five lock relays on the printer, and if they operate in sequence the printer will perform its various functions. These locks are operated when the tongue of the main line relay is in connection with the local battery and the receiver brush. When the main line relay receives negative impulses the locks will operate, but if positive or spacing impulses are received from the local battery, the locks will be disconnected. If a piece of tape without perforations except the feed holes was put into the transmitter these pin contacts would be open, then the relay pole changers would sent out negative impulses and the armature of the main line relay at the distant office and the battery would be connected to the receiver brush and all locks would operate. Therefore the perforations of the tape arrange the locks to be operated.

In regard to the synchronizing effect desired at the two terminal offices, practically the same methods are used or at least the results of methods used culminate in obtaining a unity as required in the other system.

Mechanical Action of the Printer

The circuits of the printer will be more easily understood if we first consider the mechanical actions of the printer in printing a letter. The type-wheel must first be rotated to the proper letter and then thrown forward against the paper to print. There are two rotator magnets which turn the gear shaft by means of a segment and pinion. The gear shaft is connected to the type-wheel by a pair of bevel gears and a universal joint. The type-wheel is stopped opposite the different letters by means of the selector drum mechanism as follows: On the gear shaft, in front of the selector drum, there is an index lever. The drum contains a number of stop pins and there are four interference plates between it and the index lever. These interference plates are controlled by the plate relay solenoids, which are in turn controlled by the first four locks in the lock bank. In any setting they will allow two of the pins to pass through them when the drum is operated owing to the holes in all the plates being lined up opposite these particular pins. The gear shaft will rotate either to the right or left, according to which rotator magnet is operated and will rotate until the index lever strikes a stop pin. This will bring the letter on the type-wheel corresponding to the pin, directly in front. The striker magnet is then operated and throws the type-wheel against the paper and prints the letter.

In regard to all the operations of the different parts in connection with a complete duplex sending and receiving unit, it would entail such a large volume of detailed explanation that I have only taken up certain points connected therewith.

Importance of Competent Staff

The situation now is that telegraph engineers have developed the telegraph printers to such a degree of success, and the managers and enterprising salesmen of the manufacturing companies have demonstrated their goods as an absolute necessity, and the executives of the telegraph companies being convinced that this is the case, there follows the trials and tribulations of those in charge of the organizations to see that results are obtained.

The basis of selection of staff should be along the following lines: The transmitter being of a keyboard pattern, those who formerly had typist's experience and opportunity to read various handwritings of the language in vogue would be preferred as perforating sending operators. The receiving operator requires a good general education in order to determine whether words are correctly spelled in all cases except various codes, to keep proper check of messages, to be quick acting, as the sending operator from whom they are receiving may be located many hundreds of miles away. There is also required an overseer, who is responsible for the general business, and the repair man, or electrician, who keeps the plant in order.

[In order to examine receiving and transmitting applicants, an entrance examination, copies of which were shown by Mr. McConkey, is submitted by the overseer, and by the answers, penmanship, etc., a good indication is given if the party would be suitable. This method saves considerable time as an examination orally would occupy the time of another person. A typical examination question is reproduced on page 31, from which it will be seen that the chief requisite in the applicant must be that he has a clear head and is capable of using it to form a correct judgment even under the most unfavorable circumstances.—Editor].

Growth of Battery Exchange Service

After Five Years' Experience, Has Fulfilled the Original Promise of Popularizing the Electric Vehicle

The battery exchange service, which was inaugurated by the Hartford Electric Light Company some five years ago as an auxiliary to the sale of electric trucks, appears to be fulfilling its promise of adding greatly to the popularity of the electric. This company now has a total of 88 electric trucks in operation in Hartford on the battery exchange plan, for which it has purchased some 120 batteries, or at the rate of about 1.4 batteries per car. Under the Hartford plan the customer buys the car without battery, and the Hartford company undertakes to keep him supplied with batteries on demand. By this arrangement the capital cost to the customer is reduced and a practical guarantee given that his batteries are always in perfect working order. Interesting details of this scheme are given in a recent article in the Electrical World, from which the following extracts are taken:

For almost five years the battery exchange plan has been in force at Hartford, Conn., and since the beginning it has continued to grow, until there are now 88 commercial electric trucks of different sizes operating under this plan. No figures on return of investment or showing profits are yet available, because the long life of the nickel-iron battery has made it impossible to set apart proper depreciation. Operating figures are available, and an analysis of them is given further on.

The Hartford Electric Light Company, realizing how little effort was being made by local agents to sell commercial electric cars, took the agency for General Vehicle trucks early in 1910. When snow was on the ground or conditions were otherwise unfavorable, two batteries were used in some of these vehicles in the winter. The batteries were handled in individual trays and exchanges made in less than ten minutes.

This led to the evolution of the battery exchange plan, which was first announced to Hartford firms in a letter dated November 1, 1911. The first car purchased for operation under this system went to work on June 5, 1912. All cars previously sold were changed over for operation under the exchange service as rapidly as possible.

Customer Purchases Truck Without Battery

Under the battery service system as developed by the Hartford Electric Light Company the customer purchases from the company a truck without battery while the company buys the batteries, charges them, and installs them in the customer's truck. For service the customer pays a flat sum, and for operation he pays on the mile basis, different rates being charged for trucks of different size.

According to the contract with the customer, the electric light company agrees to furnish him with a fresh battery on demand. The truck is brought up to the station when fresh batteries are needed, and the odometer on the truck is read, giving the company the number of miles of travel for billing. Two attendants are ready with a fresh battery, which is put in place of the one returned. The whole operation from the time the truck comes into the station until it leaves consumes normally about two to two and one-half minutes. The time lost, therefore, is less than the time required to fill up the gasoline tank of a gasoline truck.

The operation of changing batteries is very simple and is essentially as follows: The incoming truck is run up on a couple of slightly elevated tracks and comes to rest with the battery directly over a hydraulic lift. An attendant who is waiting slips a Cowan truck under the battery, the lift raises it to the battery, the hooks and connection of which are quickly unfastened, and the battery is lowered and taken to one side. The battery which is to take its place is all ready near by, and is quickly wheeled into position, raised by the lift and the hooks, and the connection fastened. The battery box is then locked up and the truck backs out. To perform this operation three men are employed—two for battery change and one shift man who reads the odometer.

The changing peak occurs, as a rule, between 6.45 and 8.30 a.m. From then until noon there is a let-up, depending on the weather and day. The cars commence to come faster around 11 o'clock, and from 12.30 to 3 there is a continual rush. Friday and Saturday are the two busiest days, and particularly Saturday, when the stores keep open until 9 o'clock. There is a heavy demand all day Monday, which, next to Saturday, is the busiest day of the week on exchange. On battery watering Monday is the heaviest day of all.

Batteries are charged during off-peak hours. When the peak comes on, or should an accident occur, the batteries are pulled off the lines.

But 1.4 Batteries Needed Per Car

For the battery exchange system it has been found that 1.4 batteries are needed per car. There is, therefore, 0.4 of the total number of batteries always in a position to be in charge, the remainder, of course, being in service. For the charging of these exchange batteries 43 charging panels are used. These are housed in the battery exchange building, which used to be the company's battery substation, and even now is used as a substation to some extent. Here the company also distills its own water for the batteries, using one small electric and one small steam still. The water is distilled into five-gallon carboys, of which 46 are in use. On the average about 100 gallons of distilled water is used daily. Altogether this service, with the small lighting battery business, requires the employment of about 21 men. Three shifts are used.

Since the exchange system was put into effect the numbe of trucks using it has increased materially, thereby lowering the cost of service per truck. Rates are divided into two classes—Scale I. and Scale II. Under the former the battery is not charged in the truck, and the truck is stored in a place convenient to the owner, with no provision for charging. Under Scale II. the battery is charged in the truck at

Table I.—Two Classes—Scale I. and Scale II.

	750-Lb. Wagon	1000-Lb. Wagon	1-Ton Truck	2-Ton Truck	3½-Ton Truck	5-Ton Truck
Fixed charges:						
Scale I.	$14.00 ($15.00)	$18.00 ($20.00)	$27.00 ($30.00)	$32.00 ($40.00)	$40.00 ($50.00)	$48.00 ($60.00)
Scale II.	$10.00 ($10.50)	$13.00 ($14.00)	$19.00 ($21.00)	$25.00 ($40.00)	$32.00 ($50.00)	$35.00 ($60.00)
Rate per mile, cents.						
0– 500 miles	2½	3	3½	4½	6	7
500– 750 miles	2¼	2½	3	4	5	6
750–1000 miles	2	2¼	2½	3½	3	4
For all excess above 1000 miles	1½	2	2	3	3	4

night by the company and the truck garaged by the Commercial Electric Garage Company.

The rates under the two scales are shown in an accompanying table, with old rates in parentheses. The only difference between the two scales is in the fixed charges, which it will be noticed are lower for Scale II. than Scale I., the mileage rates being the same for both. The rates for cars using the garage service of the Commercial Company are lower than for those with their own garage, on the principle that a smaller number of extra batteries are required to operate the service when the batteries are charged at night and do not stand idle until morning.

The garage company furnishes space for trucks under the following scale of charges, based on yearly contracts: 750 pound to 1-ton sizes, $100 a year; 2-ton size, $120 a year; 3½-ton, $125 a year, and 5-ton, $150 a year. These charges for space include ordinary oiling and greasing of trucks. Cars are washed on orders from owners at 50 cents for each washing. Repairs are made only on orders from owners, when the charge is 60 cents an hour for labor, with material and parts extra. Ordinary repairs and replacements on the trucks can readily be made at night, so that, except in the most exceptional cases, no time is lost by the trucks for making repairs.

Table II.—Exchange Load and Cars Stalled

	1912.		1913.		1914.		1915		1916.	
	Ju.	De.	Ju.	De.	Ju.	De.	Ju.	De.	Ju.	De.
Car days	*	*	*	949	1091	1432	1594	1188	1631	1770
Battery exchanges	*	*	*	703	633	1284	988	1152	1143	1623
Per cent. of cars changing.	*	*	*	74	58	90	64	97	70	92
Number cars stalled	*	*	*	24	12	25	3	26	16	29
Cars stalled in per cent. of car days	*	*	*	3	1	2	1 5	2	1	2

*No data obtained.

Mechanical Maintenance Contract

Efforts are being made by the lighting company to sign up exchange customers under a mechanical maintenance contract. The aim of this contract, as stated therein, is "to keep the truck in the best of running condition at all times and at the lowest cost to the truck owner by increasing the driver's interest in the proper operating and care of his truck." It is this last part relating to the drivers that is of especial interest. The company uses it as part of its refund scheme. Should the amount paid by the customer at the end of each year be in excess of the repairs actually made the excess is divided as follows: 60 per cent. returned to the customer; 20 per cent. kept by the light company, and, provided the owner approves, 20 per cent. to the driver of truck as a bonus. It is recommended that the truck owner shall pay the driver a further bonus for keeping down repair costs. However, should the amount of repairs exceed the customer's contract price he agrees to stand for 50 per cent. of the excess. The schedule on which this plan operates is: 750-pound truck, $100 per year; 1,000-pound truck, $125 per year; 1-ton truck, $150 per year; 2-ton, $175 per year; 3½-ton, $225 per year, and 5-ton, $250 per year.

It has been very difficult to interest customers in this plan, because the customers, as a rule, figure that the cost involved is too high and that they can do better on maintenance themselves. Out of 88 trucks sold on the exchange plan only 15 are on the maintenance contract. The plan, however, has been in effect too short a time to procure any figures. The contract has the valuable feature of heading off unfair criticism on the part of the customer in the matter of repairs.

For the customer's point of view the larger-size trucks are best, the operation being more economical. The demand for trucks of less than 1-ton capacity has fallen off to a point where the company has stopped selling these smaller sizes. The new rates have increased and stimulated the sale of the large sizes.

For every truck sold a dividend is paid on each truck purchased in the previous year up to twenty-five trucks as follows: 750-pound size, $4 per truck sold, with a $2 increase for each size up to 5 tons, on which the dividend per car sold is $14.

Operating Results

Since the battery exchange system was started, in June, 1912, and up to the end of January, 1917, the total mileage was 2,009,807 miles. The largest mileage in any single month was 56,402 miles in October last. The average miles per car per month since the plan was first started has been 678, with the largest month that of March, 1914, when the average mileage per car was 810 and the smallest month that of February, 1914, when the average mileage was only 309 miles. The winter months, as a rule, show a very small falling off in mileage.

The average miles per month for the 750-pound truck during the first 56 months was 655 miles; for the 1,000-pound size, 743 miles; for the 1-ton size, 456 miles, and for the 2-ton size during the first 43 months of its operation, 562½ miles. The 3½-ton size has not been in operation long enough to make any deductions.

The energy consumption through January last amounted to a total of 2,252,162 kw. hour. In 1916 the energy used for this service was 733,326 kw. hour. The average energy consumption has been 1.12 kw. hour per car-mile. In the winter months the energy per car-mile is large. The maximum was reached in February, 1916, with an average consumption per car-mile of 1.953 kw. hour.

Table III.—Showing Operations During Five Consecutive Months

	Total Cars	Total Batteries	750-LB.		1000-LB.		2000-LB.		2-TON		3½-TON		CAR MILES PER MONTH						Total Miles	Kw. hr. per Month	Kw.-hr. per Car Mile	Kw.-hr. per Rated Ton Mile
			Trucks	Batteries	Trucks	Batteries	Trucks	Batteries	Trucks	Batteries	Trucks	Batteries	Total	750-Lb.	1000-Lb.	2000-Lb.	2-Ton	3½-Ton				
August 16	78	105	11	17	22	34	36	42	9	12	....	...	720	716	697	766	627		56,052	55,836	0.996	1.125
September 16	78	106	11	17	22	34	36	42	9	13	.....	...	695	634	715	696	724		54,255	55,526	1.025	1.154
October 16	82	112	11	17	22	34	36	42	9	13	4	6	688	592	735	735	669	316	56,402	63,294	1.123	1.107
November 16	84	112	11	17	22	34	36	42	11	13	4	6	625	578	685	649	495	581	52,198	68,752	1.310	1.261
December 16	84	119	11	17	22	34	36	45	11	16	4	7	573	535	630	592	459	493	48,044	83,258	1.735	1.673
January 17	86	119	11	17	22	34	38	45	11	16	4	7	560	529	625	566	460	491	48,135	74,490	1 549	1.490

The Administrative Chairman of the Research Council, Dr. A. B. Macallum, accompanied by Dr. Adams and Dr. Ruttan, members of the Council, and the acting secretary, Mr. J. B. Challies, are visiting the most important centres in Western Canada with a view to learning by personal conference with government, university and industrial officials, how the recently formed Honorary Advisory Council for Scientific and Industrial Research can assist in encouraging the best development of the resources of the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia. The Research Council is particularly anxious to afford western manufacturers the advantages of the research facilities of the Dominion Government.

Electric Railways

Modern Track Construction as Practiced by a Large Corporation—Concrete Beam without Ties a Failure

Under the title "A Modern Type of Track Construction," Mr. R. G. Taber,superintendent of construction for the Stone & Webster Corporation, describes, in the Electric Railway Journal, the methods employed in rebuilding the recently completed double-track system of the Dallas Consolidated Electric Railway Company. As an example of the latest practice of one of the best known firms on the continent the description, which follows in part, is of extreme value:

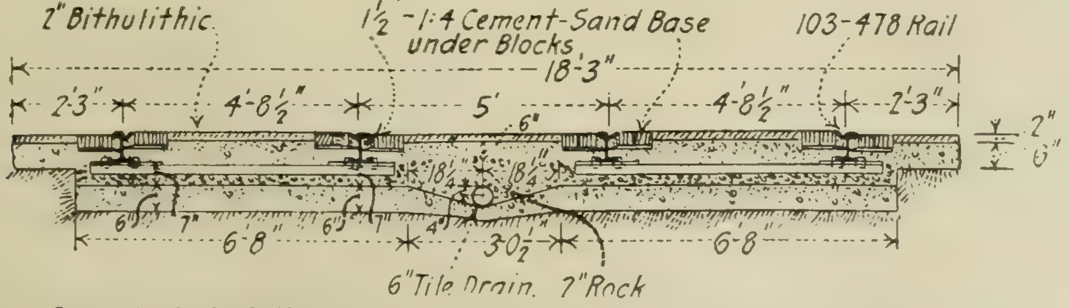
It is not the intention of the writer to describe in this article what he considers the best type of track construction, for during the last twelve years of his connection with city street railway work many concrete opinions that were formed have been "knocked into a cocked hat." There still exist considerable differences of opinion as to what constitutes the best type of track construction on permanently paved streets, not only in Dallas but also in other cities. It has been proved here, and elsewhere as well, that the concrete beam construction without ties of any nature is an absolute failure. Another type, namely, the solid concrete construction with 6-in. concrete base under 6-in. x 6-in. wooden ties, spaced on 4-ft. centers, is not considered successful by all engineers, even though it is conceded to be far better than the beam construction. The rail becoming loose, either from cutting down into the tie and concrete or from pounding joints, which in the majority of cases is the cause of all loose rails, starts a pumping action, destroying the paving foundation and paving surface adjoining the rail. It is impracticable to break out the concrete for repairs, especially where operation has to be maintained. The solid concrete construction gives a very firm roadbed, to be sure, but in my opinion this rigidity plays an all-important part in the production of corrugation; in fact, this is considered by some to be the primary cause which creates this condition. Of course, there is corrugation to some extent on street railway tracks not laid with the concrete foundation, but not so much and it only occurs where the track has been down for some time and the ballast under the ties has become compact in place, thus losing its resiliency.

With the knowledge of these defects before us, our problem was to design a track adequately drained and resilient to a certain degree, and to eliminate the well-known trouble starter, the joint. In other words, we were trying to find that type of track construction of low first cost, which gives a long life with least maintenance cost. Whether or not the type of construction which the writer is about to describe is one of this class can only be answered by time, which condemned the beam construction and brought out the defects of the solid concrete construction.

The street was originally laid with Carnegie 77½-lb. low T-rail in macadam paving. The old track was torn out with No. 19 Barrett track jacks, and the rails were hauled about 1 mile and stacked at a cost of approximately 10 cents per lineal track-foot.

Use of Steam Shovel Proves Impracticable

The excavation, which was sub-contracted, was then started, and an attempt to do this with a steam shovel was made, but to no avail, on account of the shallow cut. The shovel would take the street down only to within a tenth of the proper sub-grade and then it was necessary to dress off by hand. After a trial for two blocks the steam shovel was taken out, as it proved to be too expensive. It might be well to state here that as soon as any section of the ditch was completed, the laterals, that were to connect to the main tile drain in the centre of the completed track, were connected to the storm sewer inlets. This was done to drain the ditch in case of rain as quickly as possible and thereby to avoid delaying the work—just a little safety-first in actual construction. The ditch sloped from the outside edge toward the center. This was done to throw all seepage water into the drain and to avoid any puddling of the sub-base directly under the tracks. The trench completed, concreting was started. This consisted in placing a 6-inch concrete sub-base or concrete mat, the aggregate being bank run gravel of the proper proportion, which was lined out along the side of the trench in convenient amount. The concrete mixer, a Koehring traction paver, used this gravel as the



Cross-section showing double track construction—Note the slope of the sub-base toward the drain in the centre.

concrete was poured. Precaution was taken to have the slab slope toward the drain in the centre to prevent any water from collecting under the ties and thereby causing the ballast to become mucky.

Steel Ties Used

After this sub-base had set for about five days, the International twin steel tie was placed upon it on 6-ft. centers and the rails fastened thereto. The cross-section reproduced herewith shows the general detail of track construction used. The rail was the Lorain Steel Company's section 103-478 grooved girder with the latest curved head, this curved head being considered another aid for the prevention of rail corrugation. The rails were held together with 2-in. x 6-in. temporary wooden splice bars with a ¾-in. "dutchman" separating the rails. These joints were later welded. After the rails and the ties were in place, the ballasting followed. The method used in pulling the ballast into the track consisted in fastening one end of a rope to a scraper, passing the rope through a pulley which was hooked over a rail of the adjoining track, and tying the other end to a car. The scraper was taken out beyond the dirt pile and the car was started, causing the scraper to be pulled in toward the track, gathering a load of ballast as it came. The old adage that "necessity is the mother of invention" again proved to be true. Upon discovering that shoveling the ballast by hand was costing 12 cents per cubic yard and at that rate the item of ballasting would overrun the cost allotted, the above-mentioned scheme was resorted to, thereby reducing the cost to 5 cents per cubic yard.

Tile Pipe Used to Drain Ballast

While the ballast was being placed, the 6-in. tile drain in the centre of the track was installed. This tile was laid with loose joints, covered with 2-in. rock, the tile being tapped off with a lateral to the inlet boxes in the gutter at approximately every 1,000 feet and then connected to the city's storm sewer as previously stated. When the ballast was placed the track was lined, surfaced and tamped to the proper grade. While the surfacing and tamping were being done on one track a water car filled with water and weighing 75,000 lbs. was operated over the track previously tamped. These operations were carried on alternately until the slightest depression in the surface was cleared up and the tracks remained in good condition as to line and surface, care being taken that the ballast was thoroughly dampened while being tamped. The water car was operated over the track approximately ten hours prior to the laying of 6-in. concrete paving foundation, and by this means the ballast under the ties was thoroughly settled. The concrete paving base was then poured in the same manner as was the sub-base. At each joint concrete was left out to allow for welding.

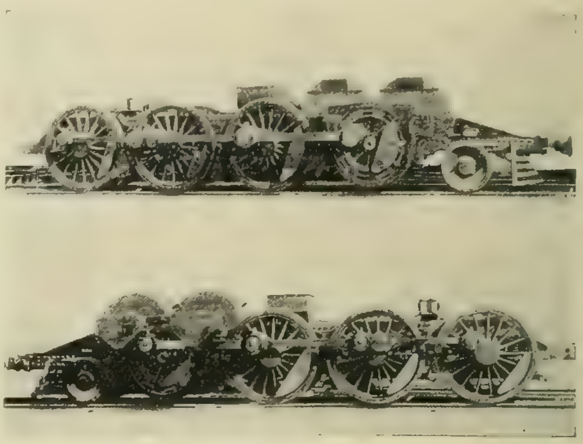
Welded Joints Used

Two days after the concrete paving base had set up the welding was begun, the temporary wooden fish-plates being removed and the joints cleaned preparatory to the welding. The type of weld used was the Goldschmidt Thermit, as stated before. This method consists briefly of placing an insert in the ¾-in. opening left when the rails were placed, the rail being thoroughly cleaned and molasses asbestos strips applied around it about 2½ inches from the joints. Molds were made by the molder and were then luted after they had been made fast to the joint. The joint was then pre-heated and in the meantime crucibles were made ready to pour when the rail ends were heated to a cherry red heat. The joint was then poured, after which it was dressed down by the grinder to the completed joint. The paving, which consists of a 2-inch surface of bitulithic pavement with two rows of 3½-in. x 4-in. x 8-in. creosoted wooden blocks on each side of the rail, followed close behind the welding.

The Most Powerful Locomotive in the World for Hauling Freight over the Mountains

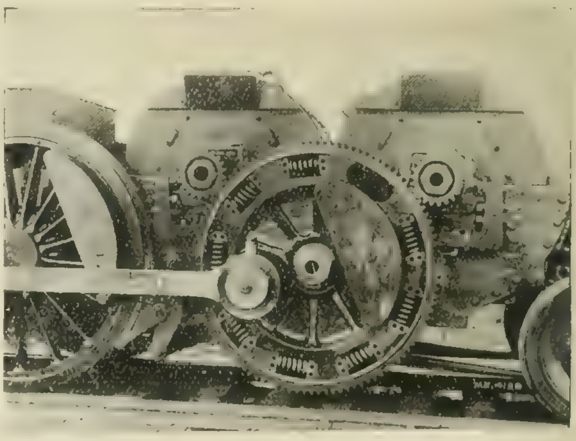
One more forward step has been taken by an important American railroad in an endeavor to improve traffic conditions by increasing the efficiency of its present track equipment. Such a step is the recent construction of the most powerful electric locomotive ever built, a joint design of the Pennsylvania Railroad Company and the Westinghouse Electric & Manufacturing Company. The mechanical parts were erected at the Juniata shops of the railroad company at Altoona, Pa., and the electric equipment built at the East Pittsburgh shops of the Westinghouse Company.

This locomotive, capable of exerting 7,000 horsepower, or more than any locomotive ever built, is the first of what will be a standard type of high powered electric freight engines of the Pennsylvania Railroad, and by them is designated as Class FF1. It is interesting to note that the design of this monster is simply another advance in railroad practice by this railroad, thus following a program exemplified by the building of the first steel passenger car.



Views of right and left sides of half unit with cab removed.

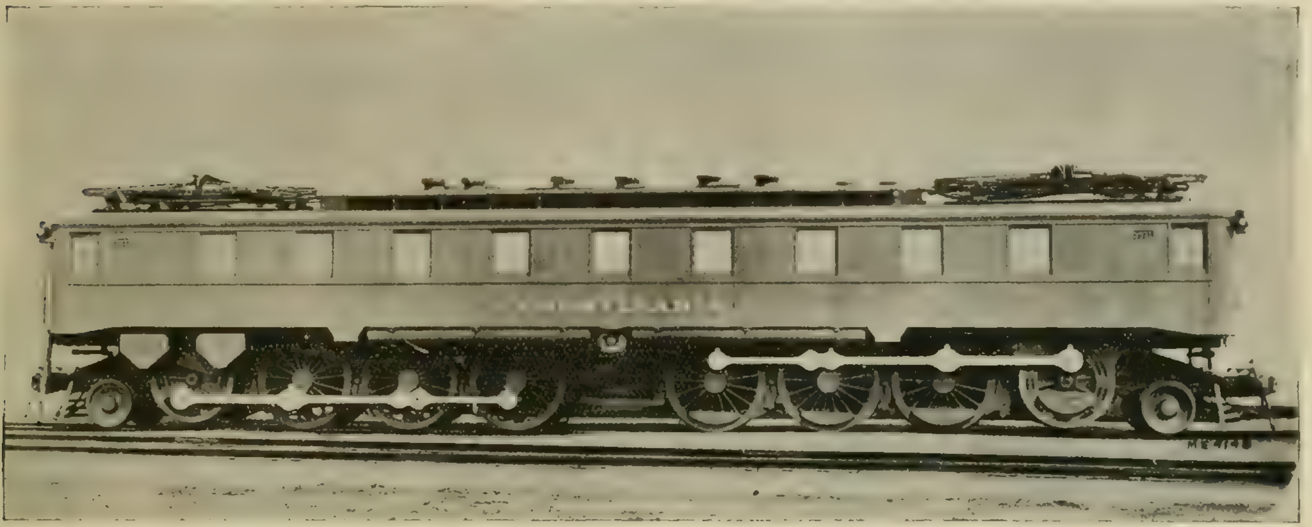
The important field of application of this locomotive will be hauling the heavy freight traffic of the road over the Allegheny Mountains between Altoona and Johnstown, Pa., including the famous Horseshoe Curve, a distance of about forty miles. The traffic over this division is unusually heavy, amounting to as much as 300,000 tons a day. The grades are unusually steep and electrification will greatly facilitate the movement of freight tonnage over this grade. East bound trains of 6,400 tons weight will be hauled by one engine pulling and one pushing at a speed of over twenty



Showing details of spring gear and motors with hollow shafts for leads.

miles an hour. In capacity this locomotive exceeds by more than fifty per cent. the power of the large electric locomotives in transcontinental service popularly called the largest locomotives in the world.

At present the locomotive is in initial service on the electrified portion of the main line of the Pennsylvania Railroad extending west from Philadelphia to Paoli, Pa.



Pennsylvania locomotive designed for freight service over the mountains.

The present plans involve the possible sending of the locomotives to the Pocohontas Division of the Norfolk & Western Railroad in West Virginia, another road electrified by the Westinghouse Company, and put into actual service there for the purpose of demonstrating its capabilities. The conditions on this road are similar to those existing over the Allegheny Mountains, namely, mountainous country, steep grades and heavy traffic. The electrical characteristics of the Norfolk and Western are also similar to those of the Pennsylvania Railroad locomotive, that is, 11,000 volt, single-phase, 25 cycle.

The locomotive is of the familiar side rod type, built in one unit, with the cab extending over the two trucks. Each truck has six 60-inch driving wheels, and has mounted on each two induction motors. The two motors on each truck are geared to a spring geared jackshaft, which in turn is connected to the driving wheels by means of the side rods. Single phase current is supplied from the trolley wire at 11,000 volts to the transformers which reduce it to a lower voltage. From here it is delivered to a phase converter which in turn changes the energy into three-phase current for application to the induction motors.

The weight of the locomotive is 260 tons and the length is 76 feet. Notwithstanding this weight the engine is much easier on the roadbed and track than a steam locomotive because the weight is cushioned and the running gear perfectly balanced for all speeds due to absence of reciprocating parts.

The engine is designed for normal running speed of 20.8 miles per hour, which is considered sufficiently high for the mountainous country, steep grades and heavy traffic to be encountered. A speed of 10.3 miles per hour, obtained by connecting the motors in "cascade" is used for slow movements such as around the yards.

The control is effected in a very simple manner by the use of water rheostats. With such success has this control been worked out, power can be applied so gradually as to enable the engine to start a long train without any jerks.

One of the most interesting features of this locomotive is the automatic regenerative braking, which permits the train to descend the grade at the same constant speed at which it ascends, and without the use of the air brake. The induction motors on this locomotive have such inherent characteristics that they will transform the electric energy from the line into mechanical energy for hauling the train up the grade. As soon as the train starts to descend, the energy produced by gravity automatically causes the motors to act as generators and in turn produce electric energy which is sent back into the line, and can be utilized by other ascending trains. Not only does this mean a saving in power, but it adds another "Safety First" feature, by permitting the air brake to be held in reserve for use in emergency and in bringing the train to a complete stop only.

The concentration of this enormous amount of power in a single cab unit of the above dimensions, is very much in excess of anything heretofore attempted. This large saving of weight and space when compared with previous electric locomotives, and especially with the steam locomotive with its tender, has only been accomplished after very careful and painstaking design on the part of the engineers.

New Type Car for Sherbrooke

A new type of car, designed by Mr. F. X. Couture, railway superintendent of the Sherbrooke Street Railway and Power Company, has been constructed in Sherbrooke, and just put into operation. The main idea in the design is to meet the local conditions, the new car being intended for the Lennoxville route. The car is 32 feet long, 8 feet 6 inches wide, and 8 feet high (inside). It is of the semi-convertible type, steel construction, mounted on a 21 E Brill single truck, and is equipped with two 101 B2 motors and resistance. The controllers are K11 manufactured by the General Electric Company. The car has exit and entrance folding doors and automatic folding steps. It can be operated from both ends as a two man car or as a one man car. When used as the latter the rear end is closed and passengers enter and leave at the front. As a two man car, passengers enter from the rear and leave at the front. Illuminated revolving route signs are installed. A whale-back top will prevent snow accumulating; the top is equipped with six ventilators. Eight heaters are situated under the seats and electric buzzers connect direct with the trolley. An H. B. lifeguard is fitted to the front end. The car is of steel, pine and red oak, and finished in birch, with a ceiling of imitation bird's eye maple. The double flooring has a lining of paper in between the boards, to keep out the frost. Seating accommodation is provided for 32 people while the standing capacity gives room for 50 additional passengers. The underneath steel frame work was supplied by Messrs. MacKinnon, Holmes and Company, and the side plates by the Jenckes Machine Company. It is proposed to build additional cars. On the inauguration trip, Mr. Couture was congratulated on the design and appearance of the car.

Accident Prevention Publicity

The Winnipeg Electric Railway Company are doing a good work through the local papers in placing before the citizens of Winnipeg the value of caution for themselves and the necessity of training their children along the same lines. We reproduce herewith a recent advertisement which appeared in the dailies of that city. The original measured 4¼ inches by 10½ inches and undoubtedly caused many a parent to pause and determine to carry out the suggestions—the wisdom of keeping children off the busy streets.

No One Can Tell What A Baby Is Thinking--

--when it toddles out on the roadway, or what it will do in an emergency. As a general rule, it does the wrong thing, and disaster follows.

PARENTS:

We are doing our part by teaching our men to be careful at all times. Do your part by keeping the wee toddlers off the streets where cars operate and teaching the growing children to be careful.

WINNIPEG ELECTRIC RAILWAY CO.

In this connection the Ontario Safety League have just distributed their third annual letter to parents, to the number of 100,000 copies, through the medium of the schools of Ontario.

We sincerely trust the educational work being carried out along the lines of accident prevention by various Canadian companies and organizations will receive the notice its importance deserves. Prevention, in general, is cheaper and better than cure, and in the case of accident prevention is doubly so.

Forestation on I. T. S. Right-of-way

The Illinois Traction System has planted about 30,000 catalpa trees along its right-of-way. It is proposed to continue this forestation from year to year with the idea in view of securing a portion of the ties and fence posts used by the company from its own groves. At the present time these catalpa groves are located within a radius of sixty miles of Springfield. The trees are set out on right-of-way so that they will not interfere with train operations. They vary in height from 18 to 24 inches and are set 5 feet apart. With average growth, they should be available for fence post use in eight years and should be large enough for ties in about ten years.—Elec. Traction.

Quebec Railway Loses General Manager

Mr. H. G. Matthews, general manager of the Quebec Railway, Light, Heat, and Power Company, died on July 4, at the Jeffery Hales Hospital, following an operation. Mr. Matthews was born in Montreal, on July 1, 1878, and received his education at Montreal High School. Before becoming associated with the Quebec company, in 1911, he was manager of the Marconi Wireless Telegraph Company of Canada. For a number of years Mr. Matthews was a member of the executive of the Canadian Electrical Association, and held the offices of second vice-president and first vice-president respectively during the last two terms.

The late Mr. H. G. Matthews.

At a meeting of the board of directors of the Westinghouse Electric and Manufacturing Company held in New York on Wednesday, June 20, the regular quarterly dividend of 1¾ per cent. on both preferred and common stock was declared; also an extra dividend of one-half of 1 per cent. both on common and preferred stock, amounting to $375,000, for the benefit of the Red Cross Fund.

The Dealer and Contractor

The Present Coal Shortage Should Mean Big Business for the Dealer and Contractor in Electric Heaters—Prepare at Once to Gather in Your Harvest

An interesting opinion on electric heating is expressed in an article by Mr. E. J. Stapleton, superintendent, Water and Light Commission, Collingwood, Ont., in a current issue of the bulletin of the Hydro-electric Power Commission of Ontario. The office of the Collingwood Water and Light Commission referred to is located in the Town Hall and has only one side exposed to the weather, three sides being surrounded by other rooms in the building. The exposed side faces south on a lane and is provided with one window and one door. This exposed side is more or less protected from the weather by adjacent buildings. Mr. Stapleton reaches the interesting conclusion that one watt per cubic foot is sufficient capacity for heating under these conditions, even with the temperature below zero. His article in full is as follows:—

At the last meeting of the Municipal Engineers, held in the Hydro Administration Building, a paper was read by Mr. F. F. Espenschied on "Heating by Electricity." The paper was both instructive and interesting and it was, I am sure, greatly appreciated by the engineers present.

Mr. Espenschied quoted Professor Osborn, of Seattle, Washington, as his authority for the statement that in a climate like Seattle, where the temperature will average about ten degrees above zero all winter, it would be necessary to install two or three watts per cubic foot of room heated. I have since read an article, in the Electrical News of February, which stated that in weather that approached anywhere near to zero two to two and one-half watts per cubic foot would be necessary, and if one is to guard against the kind of weather that prevailed in Canada early in January of this year it would be necessary to install three to three and one-half watts per cubic foot.

During the summer of 1915 I installed electric heating in my office in Collingwood, and have since continued to heat the office, lavatory, vault and lamp supply room during off-peak hours. I have clearly convinced myself that heating by electricity is the next pleasure to owning an automobile—until we come to "settle." It is absolutely prohibitive for domestic or commercial heating purposes financially.

My office is located on the ground floor, opening on to the street; the ceiling is fourteen feet high. The office has a volume of 6,174 cubic feet, the lamp and supply room 728 cubic feet, the vault 240 cubic feet and the lavatory 560 cubic feet, or a total of 7,702 cubic feet to be heated. I installed three National Electric hot air heaters of the 3-kilowatt, 110-volt type, with three-heat control. Two of these heaters are kept on the high heat, while the third is put on high for about three hours in the forenoon each day during the very severe winter weather; the remainder of the time it is left on low heat.

During February of this year I experienced no difficulty in keeping the thermometer at 65 degrees F., with the outside temperature 20 below zero. On February 9th (8 a.m.) the outside temperature was 14 below zero, on the 10th, same time, 8 below; on the 11th, same time, 3 below; on the 12th, same time, 22 below; and with two heaters on high and the third one on low, except for about three hours in the morning, the temperature in the office remained at 65 degrees.

There is no other possible way of any heat finding its way into the office, as no doors are connected with the interior of any other buildings and there is no other heating system in the office. I am, therefore, convinced that one watt per cubic foot is sufficient for heating even with the thermometer below zero.

However, assuming that such is the case, it will take approximately 27,620 kilowatt hours to heat the office here referred to during the winter heating months in Collingwood, which are from October 15th to May 15th, and figuring on 3½ kilowatts for the months of October, November, April and May and 7 kilowatts for the months of December, January, February and March, and further assuming the current at a quarter-cent per kilowatt hour, the cost of heating the premises referred to would be $69.30 compared with four and one-half tons of coal, which were used during the preceding winters previous to the installation of electric heating.

Examination of Applicants for Automatic Telegraph Printer Service, Test 6 (see page 24)

Do just as this sheet tells you, no matter how absurd it may seem.

With your pencil make a dot over any of these letters F G H IJ, and put a comma after the longest of these three words: boy, mother, girl. Then if Christmas comes in March, make a cross right here ....but if not, pass along to the next question and tell where the sun rises .... If you believe that Edison discovered America, cross out what you just wrote, but if it was someone else, put in a number to complete this sentence: "A horse has   hoofs." Write yes, no matter whether China is in Africa or not ...., and then give a wrong answer to this question: How many days are there in a week?" .... Write any letter except "g" just after this comma, and then write no if two times five are ten .... Now, if Tuesday comes after Monday, make two crosses here........ Be sure to make three crosses between these two names of boys: George..:.........Henry. Notice these two numbers, 3, 5. If iron is heavier than water, write the larger number here .... but if iron is lighter write the smaller number here .... Show by a cross when the nights are longer; in summer? .... in winter? .... Give the correct answer to this question: "Does water run uphill? .... and repeat your answer here .... Do nothing here (7-5-   ) unless you skipped the preceding question; but write the first letter of your first name and the last letter of your last name at the **ends** of the line below:

The Value of Good Sodering Flux

It is generally claimed that the secret of good sodering is more in the sodering flux than in the soder. Almost any flux will, of course, with fairly good soder, make a union of metals, but the kind of sodering job sought by the best electricians and wiremen is one that will last for many years of service without danger of corrosion or lessening in strength. Electricians who have been insisting upon getting the best soder are now insisting upon getting the same quality in the flux to be used with it. They find that no soder can be stronger than its flux, and to put good soder upon a poor flux is like putting a fine house upon a poor foundation. Wm. S. Boyd, former city electrician of Chicago, tells of a bad fire in a large building having been started from corrosion in the splice of one of the lighting wires. The corrosion reduced the cross section of the wire to such an extent that the current traveling over it heated the wire to an incandescent heat which set fire to the insulation. The fire traveled along the insulation until it set fire to the wood work, from where it spread and caused considerable damage. Another instance is related where a large paper mill was caused trouble because of not getting enough current to turn the motors properly. The engineer found the trouble due to carelessly made splices in the heavy cables. They caused considerable heating, and the resistance reduced the efficiency of the entire plant. In both instances referred to above, it was found that the flux used in sodering was an acid flux, and acid will start corrosion. L. B. Allen Company, Inc., Chicago, have for many years made a strong feature of the fact that they do not under any consideration use acid in any form in any of the Allen fluxes. Through persistent laboratory work they have discovered how to clean metal for fluxing soder without biting into the surface of the metal. They have specialized in this work for a number of years, and have developed a line of sodering fluxes with extraordinary high efficiency. They claim that test conducted by the Robt. W. Hunt Co., have proved Allen fluxes to be about 300 per cent. stronger than acid in tensile strength, and corrosive loss practically nothing. Allen flux in any of its forms is stronger than resin and is much easier to use.

Small Resistance Unit

The Electrical News is in receipt of a sample 3,000 ohm resistance unit from the Ward Leonard Electric Company. This unit is in cylindrical form, measuring 1½ inches in length by less than ⅜ inch in diameter. The resistance consists of a single layer of wire wound on a porcelain spool. The wire is then covered with a thin layer of glass enamel, which thoroughly protects it from depreciation.

EACH ONE DOING HIS BIT.
MEMBER OF HEAVYWEIGHT SQUAD CONSULTING HOYLE BEFORE GOING INTO ACTION
MEMBER OF ONE OF THE TEAMS WHO HAD NO OLD CLOTHING TO WEAR BUT AN OLD DRESS SUIT

An artistic member's view of "The Electric Club of Toronto" activities.

Let the Public Know

It is good advertising for electrical contractors to place a sign on any building construction, telling the public who is doing the electrical work there. The size of the cards should be in proportion to the distance of the work from the public eye; make them large enough to be easily read. To attract attention the more readily two colors might often be used to advantage.

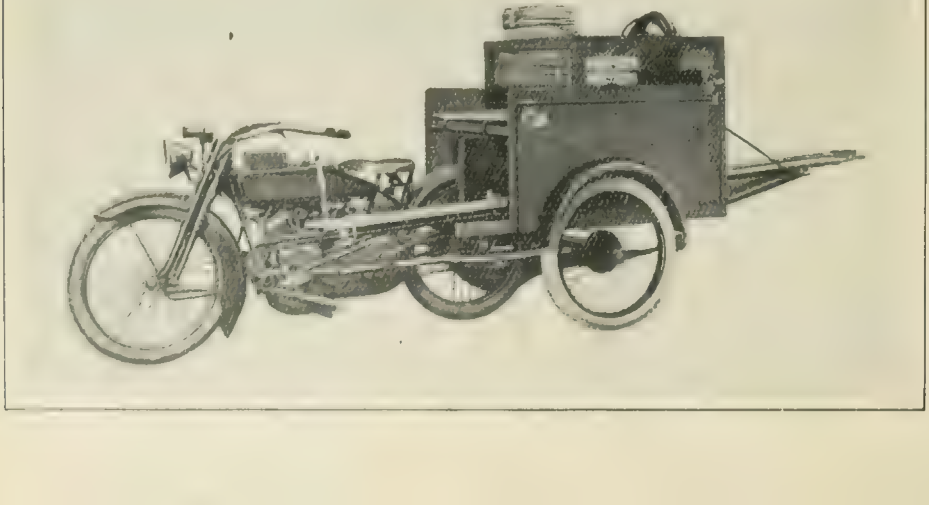
The Public Service Electric Company, Newark, N.J., has just placed an order with the General Electric Company for a 30,000 kw., 60-cycle, 3-phase turbo-generator. In addition, this plant already contains two 25,000 kv.a. G. E. units, has a 35,000 kw. unit in process of installation, and a 50,000 unit on order.

A motor-driven equipment has been invented by Mr. Dudley H. Scott, Cleveland, Ohio, for scraping his artificial ice rink. The motor was mounted on a small automobile chassis and is of 10 h.p. capacity. This tractor draws a trailer, which carries a planing blade, adjustable as to the depth of the cut. A speed of ten miles an hour can be obtained.

The officials of the Westinghouse Electric & Manufacturing Company have announced, just previous to the conclusion of a week's campaign among the employees at East Pittsburgh, approximately $10,000 has been subscribed by the employees to the Red Cross fund.

The Cygnet Delivery Car

The illustration herewith shows the Cygnet rear car, manufactured by the Cygnet Rear Car Company. It is adaptable to all standard makes of motorcycles, and is especially useful to electrical contractors, supply houses, central stations, and telephone companies. The upkeep expense of the larger trucks has been prohibitive in many cases for transferring equipment from one job to another or for delivering appliances, and so on, but with the Cygnet attachment it is claimed an average of 45 miles per gallon of gasoline can be maintained. The weight of the car is only 345 pounds, and is, therefore, very economical on tires.



Small Industrial Oil Switch

The small industrial oil switch here illustrated is used for starting and protecting three-phase induction motors up to 10 horsepower and 600 volts. It conforms strictly to safety first principles. There are but few operating parts. These are supported from the switch frame which can be mounted on any flat vertical surface, such as a wall or post, or by supports on the motor-driven machines which the switches control. All operating or live parts, with the exception of the switch handle, are enclosed. The contacts are under oil and the terminals, in the interior of the frame which is provided with a tight fitting sheet steel cover. This switch is built non-automatic; with two-coil series overload time limit trip; with plain low voltage release; and with combined lower voltage and overload protective plugs. All switches are arranged for either open or conduit wiring. They open by gravity assisted by torsion springs and have a quick downward double break per phase. The mechanism is accurately constructed and parts are interchangeable. "On" and "off" on the frame indicate whether the switch is open or closed.

The non-automatic switch is held closed by a latch. In opening, the handle is moved some distance before the latch releases, after which the contacts are rapidly snapped open. The automatic switch with two-coil series overload time limit trip is opened automatically on overload by a trip coil plunger. The switch cannot be held closed on overload or short circuit. Overload trip setting can be varied between the normal current rating of the trip coil and twice normal by a calibrating device in the tube surrounding the lower portion of each trip coil plunger. After a current setting is made, the device is locked in position by a set screw. Each trip coil is individually calibrated and the tube is then marked in legible white numerals on the black background of the tube.

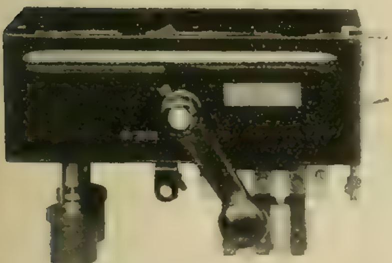


Fig. 1—Oil switch, cover and oil tanks removed.

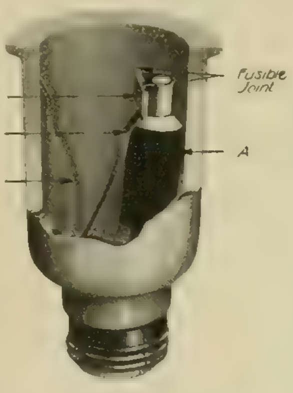


Fig. 3—Time limit protective plug.

For time delay in automatically opening the circuit, each overload trip coil is equipped with an inverse time limit attachment consisting of an oil dash pot connected to the tripping plunger. The time setting is accomplished without removing the dash pot from the calibrating tube. At proper setting, protection is afforded to the motor against overload and against running single-phase, but at the same time prevents the switch from opening while the motor is starting. The switch with low voltage trip is tripped out instantly by a low voltage release if the line voltage falls to approximately 50 per cent. of normal. To reduce the watt loss of the low voltage trip to a minimum, a small auto-transformer is used in conjunction with the low voltage release coil except at 110 volts 60 and 40 cycles, where the transformer is not necessary. Switch with overload protective plugs and low voltage trip is similar to switch just described, but equipped also with time limit overload protective plug connection in series with the switch leads. In this case overload protection is obtained by two time-limit protective plugs as shown in Fig. 3. These protective plugs contain a stationary contact post with heating coil "A," and a fusible link "B," which binds a spring contact arm "C," to the stationary post. The heating coil is in the motor circuit which also passes through the post, link and spring contact arm. When the post is heated to a temperature that will melt the low-fuzing alloy that holds the link together, the spring contact arm is released and takes the position as shown by the dotted line "D," thereby opening the circuit between the arm and the post. After the circuit has been opened by the protective plug a new link should be installed. By reason of the time lag in the heating coil, the momentary inrush of starting current will not cause the plug to open the circuit. The plugs guard the motor against any conditions of overload that if maintained for a sufficiently long period would overheat the motor. Under the conditions that exist when multiphase motors are running single-phase, or when an attempt is made to start stalled motors, or when a motor is called upon to drive too heavy a load, the plugs will open the circuit if properly applied. These oil switches are known as type F, Form P-10, and are manufactured by the Canadian General Electric Company.

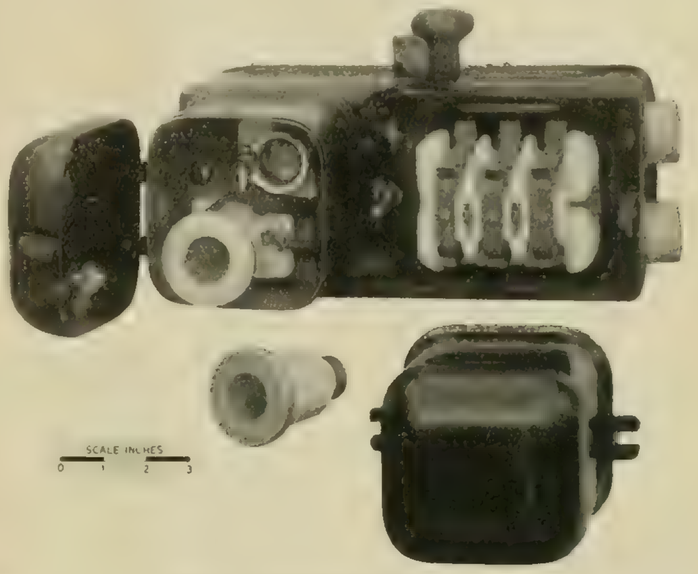


Fig. 2—Under view of industrial oil switch.

Largest Hotel in the World to Have Westinghouse Equipment

Announcement has just been made by the Westinghouse Electric and Manufacturing Company that it has been awarded the contract for furnishing the electrical equipment for the new Pennsylvania Hotel, now being erected at Seventh Avenue and Thirty-third Street, New York City. This, when completed, will be the largest hotel in the world, containing 2,200 rooms, each with a bath. The hotel is being erected by the Pennsylvania Railroad, and will be operated under the well-known Statler management. The electrical equipment consists of 44 ventilating motors, with a total capacity of over 800 horse-power; 7 pump motors, with a capacity of over 200 horse-power, and an additional number of motors for refrigerating machinery. The contract also includes three 500 kw. rotary converters, transformers, and switching equipment, and six 250 kv.a. transformers for the sub-station, to which alternating current will be supplied from the power-house of the Pennsylvania Railroad.

The annual meeting and convention of the National Electrical Contractors' Association will be held in New Orleans on October 10-13, inclusive. This was determined at the executive meeting, held in Chicago on June 19.

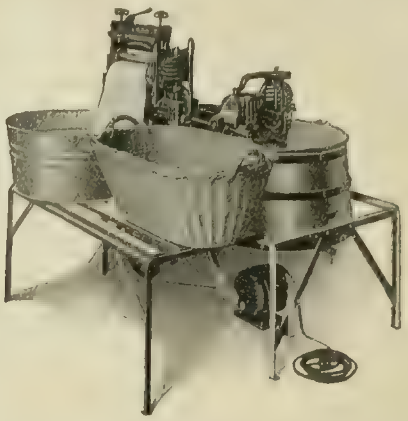
The Benjamin "92"

The Benjamin Electric Manufacturing Company are supplying dealers with an attractive display card telling the story of the now famous "92" two-way plug. This card is produced in seven colors and stands slightly over two feet in height. The illustration herewith shows this useful "salesman." Note

the various suggestions as to the numerous uses of the two-way plug. This card will prove very helpful in showroom or window. The "92," we understand, indicates that there are about that many electrical operations that may be performed by the use of this plug.

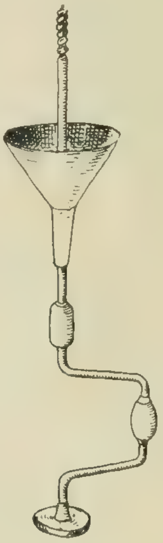
New Type Electric-Driven Washing Machine

A new type of washing machine recently developed by the Wayne Manufacturing Company, operates on the vacuum cup principle. It is claimed that this type of washer cleanses the clothes thoroughly by alternately sucking and forcing the soapy water and air through the fabric while at the same time will not injure the most delicate fabrics. The vacuum cup of the washer is made of a one-piece steel stamping which is heavily galvanized. The sides are corrugated, which gives a rubbing action on the clothes on the downward stroke and also serves to strengthen the cup. The castings which support the cup are also galvanized and attached by copper rivets. The driving mechanism which is mounted on the lid of the tub causes the vacuum cup to oscillate as it moves up and down, thus changing the position of the clothes with exact stroke. The mechanism is so controlled that lifting the lid automatically shuts off the washer. The wringer is so arranged that the wringing and washing operations can be carried on at the same time, or separately. It is reversible and provided with a quick releasing device so that in case any of the clothing should become wrapped about the rolls, the clothes can be removed without tearing by pressing the releasing lever. The wringer can also be swung as many different positions as may be desired to swing the clothes from one tub to another. The wringer is started and stopped by means of a small handle on the wringer which travels in the same direction as the wringer rolls. A central lever reverses the wringer or stops both the washer and the wringer; thus the one lever gives complete control over the machine. The washer is belt driven by a special splash-proof motor made by the Robbins & Myers Company.



To Catch Falling Plaster

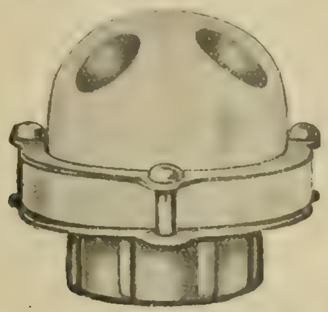
One of the most irritating things with which the housewife has to contend, when her house is being wired, is the shower of plaster which invariably falls on her delicate parlor and bedroom rugs from the drilling of ceiling outlets. Many funnel and basket schemes have been used to catch this sand and lime, but I believe the following is the simplest: Procure a six-inch funnel and slide it over the bit far enough down so that the operator can see to centre the drill. Then, by use of a screw-driver, jam a small piece of cloth, which may be kept for this purpose, down between the neck of the funnel and the bit shank. This funnel can be easily applied and as easily removed. It only requires a few seconds extra to make use of this arrangement, and results in "keeping the housewife smiling," which is the desire of every wiring contractor.—L. E. Baldwin, in Electrical Review.



The Robbins & Myers Company recently took a vote of their employees on the question of whether they would hold their annual picnic and parade, or forego the pleasure and authorize the company to spend the equivalent amount of money in Red Cross work. The vote was overwhelmingly in favor of the latter alternative. In making the appeal, it was pointed out that the amount of money spent on this picnic would purchase 500 barrels of flour.

The Cap-Swivel-Let

The Cap-Swivel-Let is a one piece swivelling conduit fitting for use on the end of rigid conduit. It consists of a bushing to which is fitted a swivelling porcelain cap which can be furnished with two or three holes. Cap-Swivel-Lets have no loose parts, no screws to lose, and are practically unbreakable. The porcelain cap is highly glazed and the holes are accurate and smooth. The Type "A" consists of a simple bushing with cap while the types "AG" and "AS" have lugs attached to bushing for grounding purposes. The standard finish of the Type A is sherardized but electro-copper plate can be supplied at a slight increase in cost. Standatd finish of Types "AG" and "AB" is electro-copper plate. This device is approved by the underwriters for meter loops, motor installations, back of switchboards and all kinds of combination work. Northern Electric Company, Limited, are exclusive Canadian distributors.



Trade Publications

Steam Turbines—Catalogue No. 42201, by the Canadian General Electric Company, illustrating and describing Curtis steam turbines of 100 to 2500 kw. capacity.

Steel Hardening—Booklet distributed by the Stroh Steel-Hardening Process Company, Pittsburg, illustrating and describing the company's method of producing wear-resisting steel castings.

Conduit Fittings—Bulletin No. 400 on Fixture Studs and Bulletin No. 201 on Armored Conductors and Fittings, by the National Metal Molding Company; bound in correspondence folder form.

Air Compressors—Form K-300-A, by the Canadian Ingersoll-Rand Company, illustrating a line of power driven, single stage, straight line air compressors manufactured by the Canadian-Ingersoll Rand Company, Limited, of Montreal. These machines are designed for motor or belt drive and are furnished with a special short belt drive where floor space is a consideration. They are intended for use in industrial and mining plants where units of 950 cu. ft. displacement and under per minute are required. Eighteen sizes are built giving a wide range of choice. "Circo" leaf inlet and outlet valves and the dust-proof, self-oiling and self-contained construction of this type of compressor are fully described.

Personals

Mr. S. L. Nicholson, former sales manager of the Westinghouse Electric and Manufacturing Company, has been promoted to the position of assistant to vice-president.

Mr. J. W. Calder, the city engineer and electrical superintendent of Swift Current, Sask., has been elected associate member of the Canadian Society of Civil Engineers.

Mr. J. H. Thompson, of Ottawa, has been elected an associate member of the Canadian Society of Civil Engineers. He is an electrical engineer specializing in wireless work, and is on the staff of the Radiotelegraph Branch, Department of Naval Service, Canada.

Mr. George E. Templeman has been appointed chief engineer of the Montreal Electrical Commission, in succession to Mr. R. H. Balfour, now sales manager of the Eugene F. Phillips Electrical Works, Ltd., Montreal. Mr. Templeman has been for some months on the staff of the Electrical Commission, in charge of the outdoor work.

Mr. A. C. Crepeau, Sherbrooke, has been transferred from the junior class to that of associate member of the Canadian Society of Civil Engineers. Since 1913 he has been in charge of work in connection with the development of Two Miles Falls, Weedon, P.Q., for the Two Miles Falls Water Power Company.

Mr. Boris Bakhmeteff, the Russian Ambassador on a special mission to the United States, has been elected a member of the Canadian Society of Civil Engineers. He has had a considerable experience in railway and hydro-electric work. Born at Tiflis in 1880, he was educated at the Institute of Engineers of Ways of Communications, Petrograd. After doing work on the Transcaucasian Railway and Simplon Tunnel, he was appointed resident engineer of the power development at Pockamox. He was also engaged in the New York Canal Barge office, and with Mr. John Bogart, consulting engineer, New York. From 1907 to 1914 Mr. Bakhmeteff was in charge of the design and general supervision of construction of several power development plants, and since 1912 has been Professor of Hydraulics and Hydraulical Engineering, Polytechnical Institute to Emperior Peter the Great, Petrograd. In 1913 he was appointed chairman of the Board of Engineering Investigation, Department of Land Improvement Ministry of Agriculture, and vice-president Department of Land Amelioration, Imperial Technical Society. He recently visited Canada in connection with hydro-electric propositions.

Lieut. Gordon C. Patterson, who went overseas with the University Company of the Princess Patricias in August, 1915, was in the famous Vimy Ridge victory, where our Canadian boys showed such conspicuous ability and "pep." On this occasion Lieut. Patterson's gallant work won for him the Military Cross. He was decorated and congratulated by the King, in person, at Buckingham Palace on June 6, on the occasion of a short leave of absence from the trenches. Lieut. Patterson enlisted as a private as being the shortest route to active service, but was some time ago granted his commission. He is the son of Mr. W. L. Patterson, president and formerly general manager of the Central Electric Supply Company, Toronto. Lieut. Patterson graduated from the University of Toronto in 1913.

Lieut. Gordon C. Patterson, M.C.

Current News and Notes

Beaverton, Ont.

The 1/0 aluminium wire on the Wasdell's system has been replaced by 5/16 and ¼ inch seven strand steel. The Hydro-electric Power Commission report that the steel wire is giving good satisfaction and that tests will be made on this line in the near future to determine the characteristics of this class of wire for transmission purposes.

Blenheim, Ont.

Extensive reconstruction work is being arranged for the Blenheim, Ont., exchange of the Bell Telephone Company.

Cobalt, Ont.

The Nipissing Central railway buildings, destroyed by fire last March, will be rebuilt this summer. The fire only affected the car barn and office buildings.

Gravenhurst, Ont.

The town of Gravenhurst, Ont., is at present negotiating with the Potash Company, Limited, for the supply of from 300 to 500 h.p. The company propose installing electric furnaces for the treatment of ore at this point.

Kingston, Ont.

The construction, by the Hydro-electric Power Commission, of the transmission line between Napanee and Kingston for supplying power to the latter city is progressing satisfactorily. The poles are all in place and insulators and wires are being installed at the present time. The Commission is now working on the design of the sub-station at Kingston, and it is expected that the transformers will be on the ground by August 15. One of the largest customers will be the Dominion Textile Company, which is expected to require approximately 600 h.p. The municipality has also submitted a figure for supplying 750 h.p. to the Kingston Locomotive Works. Mr. R. S. Kelsch is acting for the latter company and will prepare a report.

Lauzon, Que.

A transmission line will be constructed by the government between the old and new dry docks at Lauzon, Que.

London, Ont.

The London Street Railway Company have placed an order for five single truck, single end p.a.y.e. cars for December delivery. The cars are being manufactured in the United States.

Merrickville, Ont.

The Hydro-electric Power Commission of Ontario are negotiating for the purchase of a quantity of power from the Rideau Power Company, Merrickville, to supply a portion of the load of Smiths Falls and vicinity.

Moncton, N.B.

The Moncton Tramways, Electricity and Gas Company have completed their new machine shop. All the machinery is electrically driven.

Montreal, Que.

The Shawinigan Water & Power Company has just closed an important contract with the Canadian Aloxite Company, which is a subsidiary of the Carborundum Company of Niagara Falls, N.Y. This company has started to construct a [illegible] [illegible] at Shawinigan Falls for the manufacture of carborundum and other abrasives. This will be an important addition to the town of Shawinigan Falls, employing a large number of men and involving a large amount of construction. The establishment of this new work at Shawinigan further illustrates the fact that Shawinigan Falls has become the centre of electro-chemical industries for the Dominion of Canada. The ultimate amount of power involved is about 20,000 h.p.

Morrisburg, Ont.

The advisability of replacing the 3/0 aluminium transmission line between Morrisburg and Winchester with 5/16 seven-strand steel is being considered by the Hydro-electric Power Commission of Ontario.

Ottawa, Ont.

The waterworks department of the city of Ottawa are negotiating with the Hydro-electric Power Commission for the purchase of 2,600 h.p. for pumping purposes.

Perth, Ont.

The Hydro-electric Power Commission of Ontario are making a valuation and report on the waterworks and electric light systems of the town of Perth. These are at present owned by the Canadian Electric and Power Company.

Renfrew, Ont.

The engineers of the Hydro-electric Power Commission of Ontario are preparing a report on the Renfrew Power Company's plant, which the municipality has decided to purchase.

Shawinigan Falls, Que.

The Electric Products, Light and Power Company, Shawinigan Falls, Que., are proceeding with extensive additions to their plant.

Smiths Falls, Ont.

Valuations of the plants of the Citizens' Electric Company and the Smiths Falls Electric Power Company, both located at Smiths Falls, are being made at the present time by the Ontario Hydro-electric Commission, with a view to purchase.

Verdun, P. Q.

The contract for the City of Verdun underground conduit work, described in our last issue, has been awarded to the M. J. Stack Paving and Contracting Company, Ltd., Montreal.

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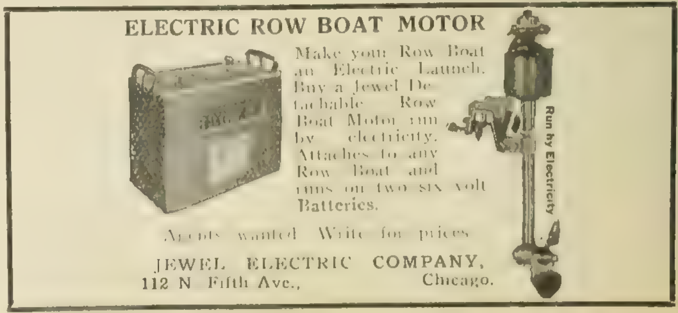
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Opportune Time to Further Popularize Electric Heating and Cooking

The uncertainty of the fuel situation would appear to make it desirable that central station managers and the suppliers of electrical equipment in general should make a special effort at the present time to establish electricity more firmly for standard use in both industrial and domestic establishments. Particularly is this true of electric heating and cooking. It is, of course, already a fact that electric cooking has become quite general in cities and towns when prices ranging around three or four cents per kilowatt-hour are obtainable, and it is no doubt true, also, that the present time is not particularly opportune for enlarging transmission capacity, which any considerable increase in electric ranges would demand. It is worth considering, however, that the immediate future of electricity following the cessation of the war will depend to a considerable degree on the extent to which it becomes established during the war through relieving the pressure caused by shortages and increased cost of other heat supply. The superiority of electric cooking is established, we believe, beyond doubt. It has also been shown that electricity at around a 3-cent rate is as cheap as gas at a dollar. It rests, then, with the central stations largely just to what extent and how quickly cooking by electricity shall be developed.

Electric heating comes under a somewhat different category. As compared with electric cooking it is more of a "seasonal" load, but during the months it would be required the load would be practically constant for twenty-four hours of every day. From the consumer's standpoint it is an absolutely desirable form of heat, doing away with all the objectionable features of coal. If a quarter-cent rate were obtainable this coming winter there is little doubt it would be quite as cheap as coal at prevailing prices. Considering the advantages, however, there are many customers of our power companies who would be willing to pay two or three times what coal costs to be relieved of the labor and filth inseparable from its use.

Even if it is a little early to look for the general use of electricity for heating our homes and offices, there is every reason to anticipate a big demand for it for auxiliary or supplementary heating. Much of the inefficiency of a coal furnace is caused by the changeableness of the temperature, which makes it impossible to standardize its operation. Electric heat, used freely as an auxiliary, can greatly improve this condition. For example, the furnace may be operated at some standard capacity suitable and sufficient for average weather and the excess cold taken care of by electric heaters. Especially this plan works out well where average heat only is required throughout a building, but a higher temperature is demanded in certain rooms or at certain hours only. These certain rooms are cared for admirably, promptly, and economically by electric portables.

Doubtless the coming winter will see a much greater use of electricity in this way throughout Canada. For the most part it would be an off-peak load particularly in the home. If the central stations welcome this form of load should they not take early steps to bring its advantages to the attention of their customers?

Toronto Hydro Annual Report Indicates General Prosperity of the Electrical Industry

The report of the Toronto electric commissioners, mentioned elsewhere in this issue, which will be ready for distribution in a few days, may be taken as an indication that, in spite of war conditions, the electrical industry is prosperous. Nor is it entirely apparent that this continued prosperity is merely the result of the war. It is true that, in this report, the item of power stands out prominently, but increases are noted in the other services as well. The reduced rates have doubtless had an important effect on the increased amount of power used, evidenced, for example, by the large number of appliances sold by the Hydro, which is only one shop (though possibly the most important) among dozens selling electric appliances in Toronto. Those who doubted the wisdom of the rate reduction a year ago are now probably willing to admit that its effect has been to greatly increase the popularity and use of electricity in every walk of Toronto civic life, which, by raising the standard of living, is in actual fact adding tremendously to the sum total of the citizens' daily happiness and well being. Compared with this a narrower margin of profit is a detail.

There is one item in the commissioners' report which, in our opinion, will not carry conviction to the citizen who is advised of the facts, viz.: where it is intimated that there has been a saving to Hydro customers during the past five years of approximately $6,000,000 "owing to Hydro competition." It is not possible to state, even approximately, what the rates in Toronto would have been if the private company had been left in sole possession of the field. On the face of it, considering the duplication of equipment and machinery in general, the actual cost of serving the citizens is greater with the two systems than with one. It is conceivable, therefore, and well within the bounds of reasonable argument, that current would have been cheaper in Toronto than it actually is if the consumers had not been called upon to bear the load of maintaining the dual organizations. The real cause of reduction in rates, however, lies, theoretically at least, in an entirely different quarter—the art of production and distribution has advanced. It is not only in Hydro municipalities that we may look for reduced rates. Take Montreal for example. In that city the light and power business is in the hands of the Civic Investment and Industrial Company. There is no competition, no agitation for municipal control, and yet the recent annual report of that company states that "rates were cheaper than those in Toronto."

However, as indicating that the electric business is prosperous and on a sound basis, that big advances are being made in the art of generation, transmission, and distribution, and that the public are realizing the pre-eminent advantages associated with the greater use of electric current for household and industrial purposes the report is entirely satisfactory. It is to be hoped that steps will be taken in the near future to remove the one big mistake in Toronto's electric supply—duplication. We have no fear that under one management the rates would be any less favorable than at present.

Iron Wire for Transmission

Results of interesting experiments carried out in the electrical engineering department of the University of Oklahoma on the characteristics of iron wire for transmission purposes are published by Associate Professor L. W. W. Morrow in a current isue of the Electrical World. Three kinds of wire were tested—¼-in. E. B. B., ¼-in. Siemens-Martin steel, and 5/16-in. standard Bessemer-steel messenger cable. Seven-strand conductors were used in each case. In order to approximate practical operating conditions a 1-mile, single-phase, 2,200-volt wood-pole line was constructed with conductors mounted 24 in. apart on 2,300-volt insulators. The line was built in the form of a loop so that measurements could be made on the generator and load end of the line with the same instruments.

The electrical tests consisted of measuring the power input to the line, the impressed and terminal voltages, the line current, the efficiency of transmission, and the regulation. The impedance, effective resistance, ohmic resistance, and reactance were calculated. Mechanical tests were also conducted on several samples of each wire to determine their elastic limits and coefficients of expansion. The results shown in the tables were obtained.

The effective resistance for a mile of wire or the resistance to 60-cycle alternating current is not constant, owing to skin effect and magnetic properties of the iron. It increases rapidly until saturation is approached, when it becomes almost constant. The Siemens-Martin cable did not show saturation effects. Its resistance increases less rapidly with current than that of any of the other wires tested, and is higher than that of E. B. B. cable for currents less than 15 amp., but less for currents greater than 15 amp. The permeability also has a marked effect on the reactance, that of Siemens-Martin cable being much less than that of E. B. B. cable of the same size.

Results of Mechanical Tests on Three Kinds of Wire

Kind of Cable	Elastic Limit (Lb.)	Elongation Up to Elastic Limit for 8 in. Section	Elongation per Deg. Fahr. (In.)
¼-in. E. B. B. cable	1,050	0.016	0.00000736
¼-in. Siemens-Martin steel	2,600	0.028	0.00000632
5/6-in. standard messenger	3,250	0.026	0.0000073

For the range of load considered (0 amp. to 50 amp. at 2,200 volts) there was very little difference in the efficiency of transmission with E. B. B. and Siemens-Martin cables, the losses being more than 35 per cent. at 33 amp., corresponding to 50 kw. At the same load the regulation is 50 per cent., indicating the prohibitive losses and poor regulation of iron wire when used at high-current density.

From the mechanical tests made it is concluded that the great strength of iron wire compared with copper enables the use of longer spans, and hence reduces the number of poles and towers required. Therefore, the interest on the investment saved may partly or wholly offset the inefficiency of transmission of iron wire. Siemens-Martin wire has the lowest coefficient of expansion and the greatest strength. Its resistance and reactance increase less rapidly with the current than for any of the other wires, and with heavy current the resistance, reactance, and impedance are individually less than the same values for other types of iron wire of the same size. At low current values Siemens-Martin wire has higher impedance than resistance. On account of the effect of iron or steel on the electrical characteristic of alloys it is doubtful whether better transmission results can be obtained from the latter than with the plain iron or steel wire. Conditions as to cost of copper, power to be transmitted, voltage, etc., will determine the advisability of using iron instead of copper wire, and also determine the type of iron wire which should be used.

Comparative Resistances of Iron and Copper Wire at 2,200 Volts

Current.	Copper.	E. B. B.	Siemens-Martin.
0	1.172	7.75	9.25
5	1.172	8.12	9.35
10	1.172	8.85	9.60
15	1.172	9.96	9.96
20	1.172	11.45	10.45
25	1.172	13.40	11.10

1800 Miles Transmission Tied Together

One of the largest systems in the world is that of the Montana Power Company, which includes, at the present moment, thirteen hydro-electric and four steam plants, all tied together by means of numerous sub-stations and over 1,800 miles of transmission line. The hydro-electric plants have a combined generating capacity of 175,000 kw. and the steam-driven plants a capacity of 6,000 kw. Another hydro-electric plant of 40,000 kw. is nearing completion, so that by the close of 1917 the capacity of this system will be approximately 220,000 kw.

This system supplies power over a territory approximately 250 miles north and south by 400 miles east and west —that is, over 100,000 square miles. Transmission is by means of 340 miles of steel tower lines, 635 miles of pin type pole line, 513 miles of suspension insulator type pole line, and 375 miles of two-pole bridge type lines.

The Montana Power Company's system is the result of the merging of a number of power service interests and a physical interconnection of their various plants, along with the construction of new plants to become part of the system. The system utilizes 47 sub-stations, 16 of which are of the outdoor type.

"Electric" Makes Long Run

That the electric automobile is admirably adapted for long runs has just been proven by an inter-city run made from Atlantic City to New York City, on Tuesday, June 19, under the auspices of the New York Electric Vehicle Association. The run is a blow to old traditions about the electric passenger car being favorable for only short trips Everyone knows that the electric is the ideal city car, but to see it take its place on the road and show remarkable speed and endurance brings a thrill to the hearts of those who have always believed in the future and the possbilities of the electric automobile.

The test was conducted purely to demonstrate the "elec tric's" speed and endurance and to show that it is not alone the ideal lady's city car, but it is also a man's road car, a capable and hardy machine. Its performance compared creditably with the best performances of gasoline-driven cars over the same route. It is even doubtful if a greater speed than was accomplished by this "electric" would be demanded by the average motorist, and it is certain that a greater speed would not be legal. The run was made in a Baker, R. and L. stock car, model Bx 7, which is a new model, and which this run practically introduces to the public. The features of this model are that it is lower hung, offering consequently less wind resistance and increased battery space.

The car left New York on Monday morning, June 18, driven by Mr. Edward Smith, of the Baker R. and L. Company, with Mr. Waldo W. Sellew, a passenger, as offical observer for the New York Electric Vehicle Association. The trip to Atlantic City, which was chiefly to investigate road conditions, was made in the comfortable time of less than eight hours, no special effort being made to make a record in speed, the plan being to make the speed effort on the return trip.

The run from Atlantic City to New York was made in five hours and fifty-eight minutes actual running time, with a boost of one hour and a half at Lakewood. The mileage covered by the car, from Atlantic City to New York, was 123½ miles, making the average running time 20½ miles per hour. The entire distance was covered with the car running at fifth and sixth speed.

One of the startling features brought out by this trip was that the current used to drive the car from Atlantic City to New York cost less than half the price of enough gasoline to drive a gas car over the same. Two hundred and eighty-three ampere hours were used in the run, an average of 2.29 per mile, the cost of which, at a 5-cent kilowatt hour rate, which is the maximum charging rate in New York City, would be $1.55.

A Joint "Engineering Council"

The national engineering societies of the United States have created an engineering council to facilitate united action by the engineers of that country in matters of a technical nature. This council is, in reality, an outgrowth of the United Engineering Society, formed some years ago for the purpose of carrying out the scheme of the Engineering Societies' Building, at 29 West Thirty-ninth Street, New York, designed to be a home for all the engineering societies of the country. The by-laws of the United Engineering Society have now been changed to admit of the creation of an engineering council formed of five representatives of each of the constituent societies and four representatives chosen by the board of trustees of the United Engineering Society. Provision is also made for the addition of representatives from other engineering societies not at present included.

This engineering council appears to be very similar in constitution to the Canadian organization, the "Joint Committee of Technical Organizations," though the scope of its membership is for the present somewhat more circumscribed. The aims are identical, in that both have been called into being to discuss matters which are common to the different branches of the engineering profession.

Electro-Chemical Society Meeting

The thirty-second general meeting of the American Electro-Chemical Society will be held in Pittsburg, October 3-6. A special feature of the meeting will be a series of papers and discussions on electro-chemical war supplies and the part the electro-chemical industry will play in the present struggle. The committee in charge is outlining an elaborate plan of technical sessions, visits to industrial plants, and entertainment features. It invites the delegates to arrive in Pittsburg on Wednesday, October 2, so as to get together informally and enjoy some recreations which have been planned for them. On Thursday, October 3, will be held a regular meeting of the society in the morning, with optional excursions to industrial plants in the afternoon. In the evening an illustrated lecture on semi-technical subjects will be given. On Friday, October 4, a symposium on electro-chemical war supplies will be held in the morning, followed by excursions to industrial plants in the afternoon. A subscription dinner will be held at the William Penn Hotel in the evening, with special entertainment features. The ladies are especially invited to be present at this function. Saturday, October 5, will be devoted to an all-day excursion, on a special train, with complimentary luncheon, to several industrial plants in the Pittsburg district.

Stimulus to Electrical Industry in England

The war has already given a great stimulus to the utilization of electrical energy in processes which before had been very little developed in this country, among which the following may be mentioned:

Steel Furnaces.—Electric furnaces are now being extensively used in those districts where the manufacture of steel is carried on, and I may quote from some interesting notes given me by Mr. Fedden, of Sheffield:

"Since the end of 1914 I have connected 27 steel furnaces, ranging in size from 260 kw. to 3,000 kw., making a total of 27,350 kw. Fourteen others are awaiting completion and connection.

"Showing the progress that furnace loads have made since the war, I estimate that by the end of next month (April) there will be at the rate of 85,000 tons of electric steel made per annum from this department's supply, making a total of approximately 100,000 tons per annum made in Sheffield.

"The chief factor in electric furnace development at the commencement of the war was due to the enormous quantity of steel turnings and the numerous other turnings in connection with war material.

"The majority of these turnings contain a good percentage of valuable alloys, and the greater portion of these would have been lost if the turnings had been melted in the ordinary steel furnaces. There is also a difficulty in dealing with these turnings in the ordinary steel furnaces, owing to their lightness and difficulty in handling, which is easily overcome in the electrical furnace."

From a steel manufacturer I get this opinion:

"The advantages of making steel by electricity are that you can get a very much better control of the heat than in any other furnace, and that you are enabled to use turnings and other scrap in place of expensive hematite iron for the production of high-class steel."

Steel furnaces have been put down in many parts of the country, as in Birmingham, Bradford, Glasgow, etc., and there can be no doubt that developments will be very considerable in all steel-producing areas, absorbing very large quanties of power.

Air Nitrates.—Another development of very great interest is the establishment in Manchester of a factory for the manufacture of nitric acid from the air, utilizing the new Kilburn Scott three-phase furnaces. The first plant to be erected, of an experimental character, will require some 1,000 kw., but, if successful, it is expected that this may develop into a very large undertaking, ultimately requiring some 15,000 kw., and it will be a 24-hour day load.

Carbide Factories.—A carbide factory is being established at Manchester, the ultimate demand of which will be of the order of 10,000 kw., mainly of an off peak character. It is estimated that the consumption will run to from fifty to sixty million units per annum.

Phosphorus. A factory for the manufacture of phosphorus will be starting at Wolverhampton next year, requiring 1,000 kw., and another 1000 kw. will in all probability be required.

Arcorundum. The manufacture of arcorundum has been started in Wolverhampton. This is an abrasive material similar to carborundum, made by fusing bauxite in electric furnaces. This is an entirely new industry in this country, and the plant at present consists of one 300 kw. furnace, with another going in shortly.

The above are a few instances of the use of electric furnaces, and there are others that cannot be referred to at present.

Beyond these larger uses of electric energy, it is interesting to note that there has been started in various parts of the kingdom the manufacture of articles that were formerly imported from Austria or Germany.

In a district in the south of England, supplied by a municipal undertaking, works are proposed, or have been started, for the production of substitute for aspirin, emollients, and other fatty medicinal products phosphorous compounds, coal tar dyes, antiseptic and disinfectant products of the formalin class, plant for acetylene welding, acids, glycerine, etc., each of these requiring from 20 to 300 kw., and in the aggregate estimated to require five and one-half million units per annum.

Over and above the development of industries as above, which for the main part concern the larger towns, there is the question of the development of the use of electricity in agricultural areas, which is a matter that concerns small as well as large undertakings.—President F. M. Long, before the Incorporated Municipal Electrical Association.

Plans for the I.E.S. Correspondence Convention

The Committee on Papers reports the following papers scheduled for inclusion in the correspondence convention:

Tentative Program of I.E.S. Correspondence Convention

Presidential address—W. J. Serrill.

Report of Committee on Progress—F. E. Cady, chairman.

Report of Committee on Nomenclature and Standards—A. E. Kennelly, chairman.

The Hemisphere as an Integrating Photometer for Projectors, etc.—F. A. Benford.

Color symposium—Introductory, M Luckiesh; physics, H. C. Richards; psychology, L. T. Troland; specifications and tests, I. G. Priest; color in illumination, Beatrice Irwin.

Importance and Value of Illuminating Engineering to Central Stations—Thomas F. Kelly (auspices Lighting Sales Bureau, N.E.L.A.).

Application of Illuminating Engineering to the Gas Industry—R. ff. Pierce (auspices N.C.G.A.).

Growth and Present Status of Systems Used in the Maintenance of Gas Lamps in Residences—E. B. Myers.

Lighting of Independence Square, Philadelphia—E. F. Kingsbury.

Lighting of Textile Mills—G. Wrigley.

Economics in the Operation of Large Lighting Installations—C. L. Law and J. E. Buckley.

Illumination Intensities in Some of the Large Department Stores in New York City—W. F. Little and J. F. Dick.

Illuminating engineering Advertising—G. H. Stickney.

It is planned in a few weeks to arrange these papers in groups for release during respectively September. October, and November, and possibly December, of 1917. Early in [illegible] will be sent to any one who may apply for them to the general office, and will be accompanied by invitation to submit a written discussion. The boards of managers of sections may, if they wish, utilize such papers for section meetings held in the month of release. In some cases it may be possible to have the papers presented by the authors before such meetings. Local representatives also may, if desired, arrange for meetings in their territory, at which the papers may be presented during the month of release. At a date to be fixed, but probably about the 20th of the month, the papers will be released for publication or abstract by the technical press. All discussion of each paper during the month of release, whether delivered at a meeting or submitted in writing to the general office, will be brought together and printed with the paper in the transactions of the society. Further details will be announced later.

Effect of the War on U.S. Imports to Canada

Reports were prevalent a few weeks ago that the entry of the United States into the war in Europe had stimulated to a considerable degree electrical trade with Canada. While such reports may have been true for other manufacturing industries, a careful investigation has disclosed no material increase in electrical exports to Canada. In fact, in some instances it was found that America's entry into the war was a signal for decreasing trade. This was found to be particularly true of the Canadian paper and pulp industry, much of the electrical equipment for which is of American manufacture. A number of projects were scheduled for development shortly, but simultaneously with the entrance of America into the war these plans were either abandond or postponed indefinitely.

Of course, it must not be lost sight of that some of the larger American manufacturers have established Canadian factories or have connections in Canada in which they have substantial interests whereby goods of Canadian manufacture but identical in design with American goods are marketed in Canada. These plants which are largely financed by American capital and buy probably most of their raw materials from the United States, have been established in Canada as a means to compete in the Canadian market without the necessity of having to pay import duty.—Electrical World.

Collecting Accounts in Saskatoon

Any item which reduces the cost of collection of accounts is always of special interest to the central station, and we have pleasure in passing along the following bit of information which has just been received from Mr. Edward Hanson, electrical engineer of the city of Saskatoon, Sask. Mr. Hanson says:

"It may interest your readers to know that a new system of collection recently inaugurated in Saskatoon has proved very successful.

"To satisfy a demand for branch collection offices by consumers in the outlying districts of this city, we decided to have the meter readers collect the account when reading the meter. This has proved highly satisfactory to all concerned, and an increasing number of consumers are taking advantage of the privilege."

B.C.E.R. Would Sell Out

It has been intimated by Mr. George Kidd, general manager of the British Columbia Electric Railway Company, that the company is willing to dispose of its entire holdings in the province, provided satisfactory terms can be secured. The figure set for the holdings on the Lower Mainland is approximately $30,000,000 and the company is prepared to accept $25,000,000 in bonds bearing interest at 5 per cent. and the remaining $5,000,000 without interest for five years.

Water Powers of Northern Alberta and Saskatchewan—The Last of a Series of Articles Dealing with the Middle West Provinces

In the most northerly parts of the Provinces of Alberta and Saskatchewan there are a number of very large water-powers available which, however, are too far removed from transportation facilities to be very valuable as yet. Lake Athabaska lies across the border line, between Alberta and Saskatchewan. It is drained by the Slave River, which empties into Great Slave Lake. The latter body of water is drained by the Great Mackenzie River, which flows in a northwesterly direction through the district known as the "Northwest Territories."

The Peace River

Peace River is formed by the junction of the Finlay and Parsnip Rivers, in the Province of British Columbia. It flows in a general northeasterly direction and empties into Lake Athabasca. Its total length from the source of its principal branch is 900 miles.

The Peace River has a maximum discharge, measured in the month of July, 1915, of 338,850 second feet and a minimum, measured in December of the same year, of 10,250 second feet. The largest estimated water-power is at Peace Canon Rapids, where, in a length of 18 miles following the river, 11 miles across portage, there is a fall of 225 feet. Peace River Canon is situated in British Columbia, just outside of the western boundary of the Peace River block. The descent in the canon is fairly uniform, except near the head, where there is a fall of approximately 25 feet in half a mile. At the narrowest point the distance from bank to bank is only 200 feet. On a basis of 11,000 second feet flow, the available water-power is estimated at 282,000 h.p.

At Vermilion Falls and Rapid there is a descent of 26 feet in a distance of a mile and three-quarters. The Commission of Conservation report estimates that the low-water flow during the open season is 24,000 second feet and the available horse-power 71,000.

There is also a rapid falling eight feet over a distance of a mile at Boyer, or Little Rapid, situated less than 100 miles from Lake Athabaska.

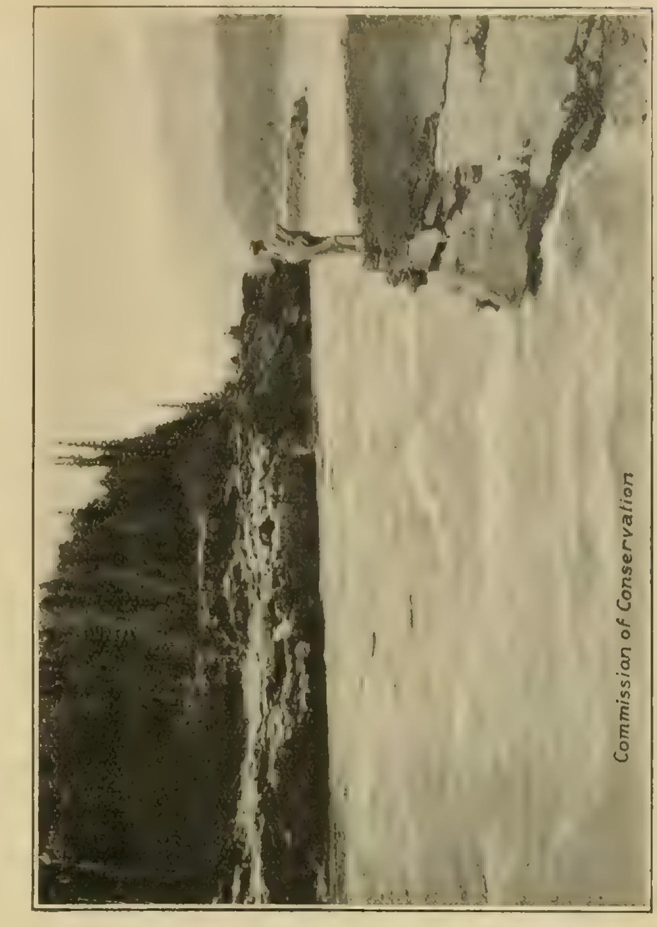
Athabaska River

The Athabaska rises in the watershed range of the Rocky Mountains, close to the boundary line between British Columbia and Alberta, and flows in a northeasterly direction into Lake Athabaska. Its total length is approximately 780 miles. Throughout this distance there are a number of falls, roughly estimated at 20, varying in height from 16 to 80 feet. The estimated low-water flow during the open season is placed by the Commission of Conservation report at 11,500, and on this basis there is an available horse-power of approximately 400,000, the largest of which is Grand Rapid, with 67,000 h.p. Four others are estimated at 36,500, 36,000, 32,500, and 26,000.

A number of tributaries add to the volume of the Athabaska River as it approaches the lake, but the water-powers on these rivers are not important. Five rapids listed on the Clearwater River with heads up to 41 feet give a total of 15,000 h.p. The Lesser Slave River, also with five estimated rapids, give a total of about 10,000 h.p. Stony River, with 75 foot fall and 200 second feet capacity, gives an estimated 1,700 horse-power.

Black River

The Black River rises in Wollaston Lake and flows west by north to Lake Athabaska. There are a number of falls and rapids of considerable height, one rapid having a 160-foot descent in two miles, and another 120 feet in three miles and



Peace River—Head of Peace River Canon

Slave River—One of the Fort Smith Rapids a half. The estimated low water flow is estimated near the mouth at 5,000 second feet and the largest water power at 107,000 h.p. The total power on this river is approximately 250,000 h.p.

Wollaston Lake, situated in the north-east corner of the Province of Saskatchewan, is fed by the Geikie River, on which there are a number of falls and rapids, varying in height from 45 feet down. The estimated low-water flow near the mouth of the Geikie is 3,200 feet, and the estimated power available during the open season totals approximately 45,000 horse-power.

Slave River

The waters of Lake Athabaska, which is fed by the Black, Athabaska, and Peace Rivers, as well as a number of smaller streams, are emptied by means of the Slave River into Great Slave Lake. The estimated low-water flow during the open season on the Slave River is 70,600 second feet. There are five rapids, giving heads respectively of 13, 10, 25, 42, and 27 feet. The length of the Slave is approximately 290 miles. The horse-power available at the five falls works out at 104,000, 80,000, 200,000, 336,000, and 216,000, or a total of 936,000 h.p.

The Northwest Territory

A considerable number of falls throughout the Yukon and Northwest Territories have been measured, but no reliable figures are available as to the capacity of the rivers. Falls vary in height from 250 feet down, with a total of 76 listed. Two water-powers in the Yukon district have been partly developed—one on Twelve-Mile River, where there is a fall of 710 feet, but only 2,700 h.p. has been utilized by the Yukon Gold Company. The Canadian Klondike Power Company has developed 10,000 h.p. on the north part of the Klondike River, where a head of 228 feet is available.

Engineering and Trade After the War

By Mr. S. F. Ricketts

Consideration of Canada's future after the war is a matter which has received a great deal of individual thought, but a limited amount of discussion. Yet we seem to have reached no decision as to where Canada will be in the great economic struggle that must inevitably follow.

As with all nations, the present so entirely overshadows the indefinite future that many of us are forced by pressure of circumstances to leave the future to take care of itself. Three years of war has not caused the political strain to ease up in Canada—in fact, we cannot imagine a time less opportune than the present for sober and whole-hearted consideration of this immense problem. Yet this question must receive prompt attention if we are to have a future that will minimize the effect of the changed economic conditions that will prevail after the war.

Senator Frederic Nicholls' review of the situation, in his statement during debate on the "Conservation of Canadian Trade," on June 5, brought before us the essential fact that a committee should be appointed to obtain and present to the government "the best means of conserving and increasing our domestic and overseas trade, to the end that our present prosperity may not unduly suffer when the stimulus resulting from orders for munitions and other war supplies is removed."

To understand the position in which Canada now finds herself and to more fully accentuate the possibilities of the future, we need to have a wide knowledge of the conditions which prevail in the overseas market. Unless we can fully visualize the foreign situation as it has been related to Canada in the past we shall never be able to conceive an industrially complete Canada for the future.

Great though Canada's efforts may have been in the past, considering our population and available capital, our problems have been almost entirely domestic. Our manufacturing export trade is practically nil, if we leave out of account special war orders and munitions. It has always been small compared with other manufacturing countries and with our neighbors to the south. We claim to have the natural resources, but we have been more concerned with trading in bulk in raw material and foodstuffs rather than in utilizing these resources for manufacture and thus providing labor for an increasing population. Realizing that Canada's future was wrapped up as much in her manufacturing interests as in wholesale land products, we have stimulated our domestic trade by imposing import duties, thus forcing manufacturing interests to locate factories on this side of either the border or the Atlantic. Due consideration should be given this important point, as it is the governing factor in the whole situation, irrespective of arguments for or against free trade. Manufacturing agreements and domestic policies govern Canadian business perhaps more than we care to believe when we are concerned with expansion, and, unless these relations change, there seems a poor chance that Canada's engineering interests will develop beyond her domestic possibilities.

Export Prohibited

If we analyze this relationship of Canadian manufacturers we find that all the steel, bridge, and iron producers and suppliers, large electrical and mechanical machinery manufacturers, motor car builders, chemical factories and implement makers are branch companies of, or allied to, larger United States or English concerns. Whilst possibly financed or directed from Canada, they have their hands tied as far as exporting is concerned. Turn over the pages of the Electrical News or any other trade journal and see what firms have interests abroad that can take manufactured articles from Canada. It is simply that the parent organizations in other countries are interested in the export business and have divided up the territory, often one foreign country to the United States house and another to the English; or, in the case of the steel ring, the business is quoted on so as to ensure the order going to the desired country.

If these facts are correct, can we expect that Canada is going to have any more of the export business after the war than she had before. There is, of course, a portion of the general manufacturing trade that could be organized for export, but in many cases their present products—like the big furniture business of Western Ontario—are not suitable for the foreign market, or would not compete in the United States or in Europe.

How, then, shall we arrive at the solution of this problem of after-the-war trade?

We must divide the question into two parts, viz., the domestic and foreign. The domestic problem depends almost entirely upon the financial aspect after the war—as to how readily Canada can obtain money with which to finance her plans. We must remember that Canada's troubles dated two years previous to the war, and the present prosperity is almost entirely due to war orders. Our first thought must be as to who is to have the spending of the money in domestic trade, for unless we have some plans there will be no demand. It is impossible to suppose that we shall revert to the money-mad days of 1910-12, when Western municipalities built up huge debts, on which they now labor to pay interest. That there will be land booms and an increase in building in some parts, due to an influx of immigrants, is certain, but most of this influx will be into settled country, where paving and sewer extensions will not be so elaborate as in pre-war days. Consequently with municipalities the demand for engineering requirements will be light. In this connection we must remember that most of the available land near railways is occupied, and railway extensions cannot be looked for under the unsettled railway conditions. We may expect an increased demand on our lighting plants and consequent extensions, for it is this side of municipal enterprise which pays for itself, resulting in a limited demand on manufacturers of apparatus. It is hardly to be expected, however, that the local street railways will develop further for some time, as most of them have long since exceeded the profitable development stage, and will meet all local requirements. But we have the long overdue development of the inter-urban and radial lines to expect. Then there is the all-important and urgent business of shipbuilding to care for, and this will tax many of our plants for long after the war. It is probable that no depression will be felt in the domestic motor-car industry, for it is recognized that the farmer is the man to-day who is buying the car, due to his enormous increase in ready cash; and it is not to be expected that prevailing high prices for foodstuffs will come down for a number of years after the war. This increase in farmers' profits has also created a huge demand for agricultural machinery, and the return to the land of disbanded semi-skilled men will lead to more land being put under cultivation and a greater demand for implements. Just what this demand will consist of is largely the crux of the situation, and of vital interest to present munition plants.

Establish a Foreign Trade Bureau

If immigration is the factor on which we must rely, then we can see, as a natural result, that furniture factories, shoe and clothing manufacturers, lumber mills, cement and building material suppliers, and all makers of personal requirements that employ so much labor will be busy as soon as the tide has set in. Meanwhile these manufacturing interests are nearly all busy meeting domestic demands due to the present prosperity, and it is only to be expected that these demands will continue for a while, as the momentum of prosperity is such that it is against human nature to limit spending until the source is nearly dry.

Turning now to the foreign trade, we have to remodel our former thought to meet the conditions that will exist. It was stated above that, in the export trade, our bigger manufacturers were ruled out by agreements, but it is conceded that this did not apply to munition work and special equipment orders that did not compete in certain territory, but were recognized as urgent war orders. In the matter of the regular products of these factories, however, this condition will not continue after the war. We can expect nothing but our domestic requirements to govern these manufactories, whatever the foreign policy of the government. There is, however, another ray of hope in the suggestion that the government establish a trade bureau to secure foreign orders for our factories, provided the same conditions prevail that made it possible for the Imperial Munitions Board and the War Purchasing Committee to operate. These conditions are that money will be available for reconstruction work in Europe immediately after the war, and that the demand for material will be greater than can be supplied from England, Europe, and the United States. That our steel, iron, and shipbuilding interests will be busy for many years is sure. But that our electrical manufacturers will be permitted to supply material, even for reconstruction work in war territory, is doubtful. The motor-car industries of this country are not likely to be interested in foreign orders, as they mainly confine themselves to Canadian territory and have a domestic demand fairly well assured. The surplus of cars now used for military purposes will also be available. There is, however, a considerable balance of our general manufacing interests, such as our huge lumber mills, furniture factories, building suppliers, rubber goods producers, and packing houses, which, if properly organized, could be drawn on for reconstruction requirements without complications, and to such a degree that it would tend to even up the labor demand.

If the above represents fairly closely the domestic and foreign situation, what, then, is the solution?

A Possible Remedy

Seeing that the interests of these two spheres are so disconnected, it seems that there is nothing to do but to provide for each in its own special way, although in many cases the details could be worked out to include both. Were a committee to be appointed by the government to consider and report on the situation the following suggestions might form a basis for investigation:

1. That a minister of home and foreign trade be appointed, with cabinet rank, having a permanent staff, free from political influence.

2. That the permanent staff have two separate heads, who shall be responsible, one for domestic requirements and the other for foreign trade, but whose staff shall be so related that it could work in conjunction on joint problems.

3. That the local boards of trade, now existent in nearly every city and town, be recognized and appointed officially as advisory councils, through which co-operation could be maintained.

4. That a government bureau of labor be set up and maintained in every district in which an officially recognized board of trade existed, to permit of a freer distribution of labor throughout the country. This bureau to concern itself only with the registration and distribution of labor, and not to detract from the duties of the minister responsible for labor and factory conditions.

5. That the home department shall act in an advisory capacity only, with no arbitrary powers, the intention being to place in the hands of all manufacturers reliable information on special subjects that will tend to promote the welfare of the manufacturing industry and keep down costs. (It will be to this department that present munition manufacturers will look for help immediately after the war. Having in view the enormous amount of capital invested in machinery, it is a duty the country owes to all concerned that advice be given as to the use this machinery can be put to, combined with the skilled and semi-skilled labor. The matter is of urgent importance if we are to keep together the organizations now running.)

6. The foreign department shall seek for and advise Canadian manufacturers of all foreign business offering, and shall work in conjunction with the British and foreign governments where orders can be obtained. In order to do this satisfactorily it might be necessary to set up a similar board to the War Purchasing Committee, that would be free from charges of bias and favor. (We must consider that for years the United States Government has had a bureau of commerce which obtains, through its consuls and trade commissioners, all the information available and useful, and distributes it to manufacturers by circulars, stimulating business that would never be known to exist.)

7. That the foreign department shall be responsible for appointing and maintaining commercial agents in foreign and European countries, whose duty it shall be to advise both purchasers and manufacturers, through the medium of the department, as to general business conditions, language re-

quirements for literature and for travellers, openings for special trade, and the placing of agencies, but whose duties shall not include that of either selling or purchasing agent, except perhaps for government orders. (It is advisable to remember that in most foreign countries it is not possible for a home manufacturer to do business direct with a customer, as, except in special lines, the latter is suspicious and has no redress for complaints, whilst for the shipper there is the risk that his draft will not be taken up. Local agents are always available, but it needs a man of experience in the country to select these agents. Also local agents may have their hands too full of a wide range of specials, and cannot give their time to developing business. To overcome this difficulty and to avoid duplicating agents in territory that would not repay an agent's individual attention there was formed in London a large corporation known as "Representation of British Manufacturers, Limited," comprising most of the leading engineering firms, whose object was to place managers in certain territories to handle a large group of carefully selected engineering apparatus whose interests did not clash. The war, however, interfered with this development. With Canadian business placed as it is a similar combination would hardly be possible, but it shows the need of careful handling.)

8. That a trade banking system be organized, having for its object only the financing of the moving of manufactured goods for manufacturers or recognized shippers. (That this is necessary can be ascertained by any manufacturing interest applying for financial accommodation to its bank for abroad. Most Canadian banking institutions have little knowledge of foreign currency and only round-about means of providing for such business. When one has to consider that some countries have only a silver currency, on which the exchange varies widely as often as twice per day, the necessity for special arrangements is apparent. Affiliation with local British banks in foreign countries could be arranged by a government establishment that laid itself out for that purpose, without the necessity of establishing branches in every country.

The above tends to show that Canada has much to gain and little to lose by prompt action but the main point is, with the war so much on our mind and so uncertain, have we men available to handle the situation and such schemes?

Toronto Hydro Annual Report

The report of the Toronto Hydro-Electric System for the year ending December 31, 1916, the sixth of its kind, has just been made public. This report is particularly interesting as representing the operations of the largest municipally-controlled electric distribution system in the Dominion.

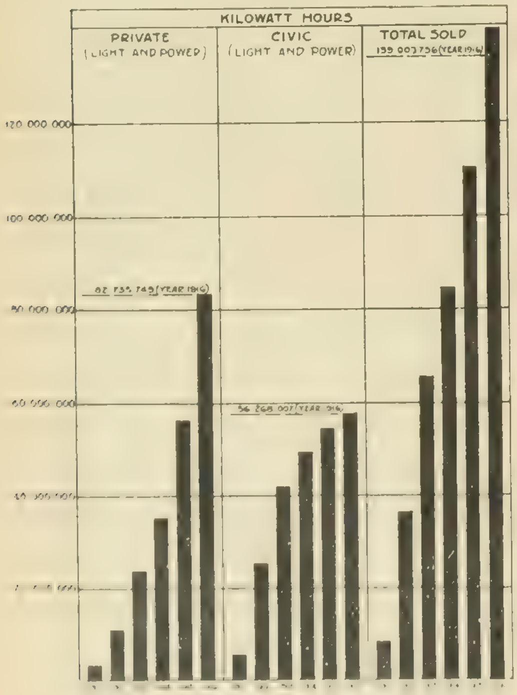
The report shows that the operations for the year 1916 resulted in a gross income of $1,706,177, and, after deducting the cost of electric current and the expenses of operation and management, including repairs and maintenance, there was a surplus of $634,042. Of this latter amount, interest, depreciation, and sinking funds absorbed $615,646, leaving a net surplus of $18,396.

It is pointed out that the gross income is 5.3 per cent. in advance of that for 1915, and that the increase in the commercial income was 5.5 per cent.; also that the fact that the commercial income for the year amounted to 67 per cent. of the total indicates the support the general public are giving to their system.

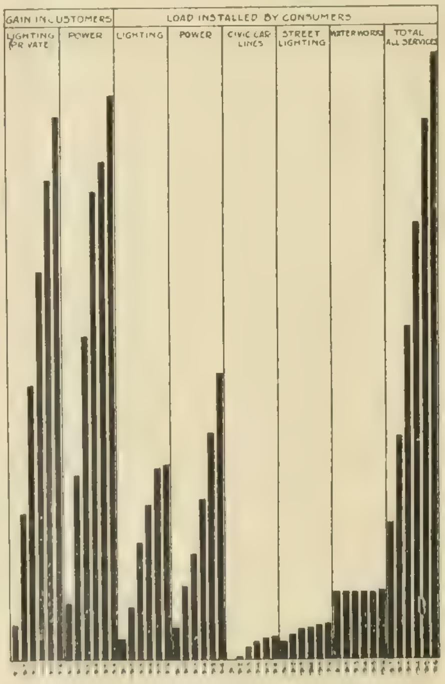
A number of interesting points are brought out by the general manager, Mr. H. H. Couzens as follows: (a) The total kilowatt hours sold in 1916 are greater than in 1915 by approximately 27 per cent.; (b) the total revenue shows an increase of 6 per cent. in spite of rate reductions; (c) the total number of private customers is 43,460, with a connected load of 70,500 kilowatt hours; (d) capital expenditure amounts to $6,902,000; (e) the sustained 20-minute peak load on December 4, 1916, was 47,165 h.p.; (f) the average revenue per kilowatt hour for the whole system was 1.2 cents in 1916, as compared with 1.44 cents in 1915.

One of the most noteworthy items in this report comes under the heading of "operation and maintenance." It is shown here that the total number of kilowatt hours sold is 139,000,000 in 1916, compared with 109,000,000 in 1915 and 83,000,000 in 1914. In spite of these heavy increases, however, the total cost of operation and maintenance has shown a consistent decrease from $550,000 in 1914 to $548,000 in 1915 and last year to $543,000.

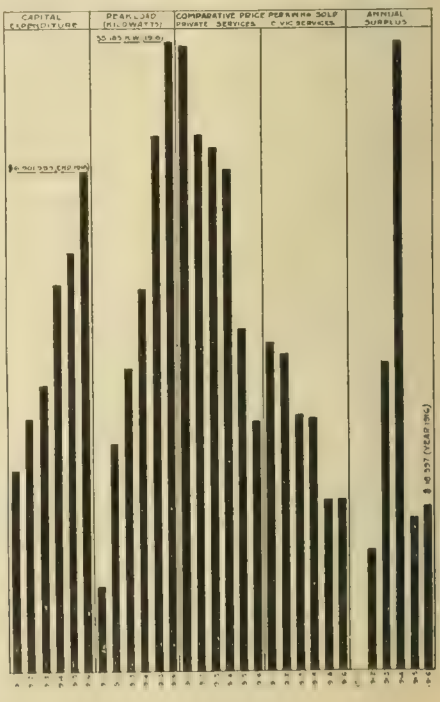
(Continued on page 37.)



Growth in sales of electric energy year by year, Toronto Hydro.



Growth of business year by year. Separate services, Toronto Hydro.



Capital expenditure, peak load, revenue (per kw h. sold) and surplus, year by year.

Electric Railways

An Automatically Operated 1,200 Volt Electric Railway Sub-station, the First of Its Kind—Wiring Diagram Shown

An automatic 1,200-volt sub-station has just been placed in operation by the Milwaukee Electric Railway and Light Company, and it is stated, is the first of its type at this high voltage. The wiring diagram reproduced herewith and the description of the sequence of operation are taken from a recent issue of the Electric Railway Journal. A considerable saving is effected on this line by automatic operation, since the sub-station is operating only part of the time; there is a total of approximately seven hours a day that the automatic sub-station is cut out when it would be running under manual operation. The principal factor in the economy of operation is the elimination of two operators, the total estimated saving being $1,767.86, which does not take into account the energy saving due to the elimination of iron and copper transformer losses which are also off the line seven hours a day; nor does it include the energy saving in line losses during this period of no energy flow over the high-tension line.

Sequence of Operations in 1,200-volt Automatic Station

Beginning with the machines off the line, everything inside of the station is dead except the small transformer which supplies energy to the control apparatus and the contact-making voltmeter, which, of course, is always energized. When the voltage drops below 950, the contact-making voltmeter, marked No. 1 in the figure, closes a circuit through the double-contact relay, No. 2. This in turn completes the circuit through the dash-pot relay, No. 3, which provides the time lag holding the machine on the line for five minutes after the demand for current falls below 25 amp. This third relay is called the master relay, since it really determines whether the machine shall be kept on the line or cut off. With No. 3 relay circuit closed, a circuit is completed through the low-voltage relay which cuts the machines off the line whenever the high-tension voltage drops so that on the 220-volt side of the control-apparatus transformer the voltage has fallen to 180. It also includes two overload relays one for each machine. No. 39 relay is also connected in this same circuit, and is held in the closed position by virtue of a separate circuit off the 220-volt bus, which includes the four thermostats, located on the bearings of the two machines and the two thermostats on the main resistance grids. If any of the thermostats open the circuit ,this de-energizes the No. 39 relay, and hence cuts the machines off the line. With No. 39 relay and the previously-mentioned relays closed, contactor switch No. 4 is energized and closed, supplying energy to the lower half of the main controller drum. As soon as energy is supplied to the drum the No. 19 finger completes the circuit through the the No. 6 contactor. This closes and energizes the small induction motor which is connected to the controller drum through worm and gear and direct-connected to the small 250-volt direct-current exciting generator. The drum then begins to revolve, and from then on all operations of the apparatus are controlled from this point. The several operations are so timed by virtue of the construction of the drum that each step is given time to complete its function before the circuit operating the next step is completed. The No. 18 finger on the drum is the first to make contact after the drum begins to rotate. This closes a circuit through the No. 5 contactor, which in turn closes the 220-volt circuit to the top half of the drum, and also an auxiliary circuit through all the overspeed cut-outs on the rotaries, the auxiliary control on the main oil switch and the reverse-current relay.

When fingers Nos. 1 and 2 make contact on the drum, the half-voltage-tap contactor on the ground-side rotary converter is closed. While the machine is coming up to speed, the drum continues to revolve until the No. 3 finger makes contact and closes a circuit through a contactor which puts current from the small direct-current generator having a fixed polarity through the field of the rotary. This current is supplied just long enough to determine the correct polarity of the converter, when it is disconnected and the main field switch of the machine closed, making it self-excited. This occurs at the same time the half-voltage contactor switch is thrown out and the full-voltage contactor thrown in. These last two contactors are mechanically and electrically interlocked and cannot be connected at the same time. The first machine at this point is operating at synchronous speed, and almost instantaneously with the closing of the full-voltage contactor on the first machine the half-voltage contactor on the second machine is closed. The same process then follows through for bringing the second machine up to speed, except that its field is energized from the armature of the first machine. This is done because it makes it impossible for the second machine to polarize in the wrong direction and because it eliminates one field contactor. The field of the second machine is continuously excited from the first machine in order to limit the maximum pressure in the field coils of the second machine to 600 volts. If it operated under self-excitation the maximum voltage in the field coils would be 1,200. With both machines up to synchronous speed, the last fingers on the controller close the main line contactors, throwing the machines on the line through resistance, which is then cut out by contactors in three successive steps at about one-second intervals.

When the current demand is below 25 amp. the current relay drops, short-circuiting the resistance in series with the volt-meter to take the lower position, short-circuiting No. 2 relay and allowing No. 3 relay to drop. The latter is retarded by its dash-pot, and does not break contact for the period of five minutes and ten seconds. When this finally opens, all relays are de-energized and the station is completely cut off back of the transformers at the main oil switch.

Protection for Automatic Control

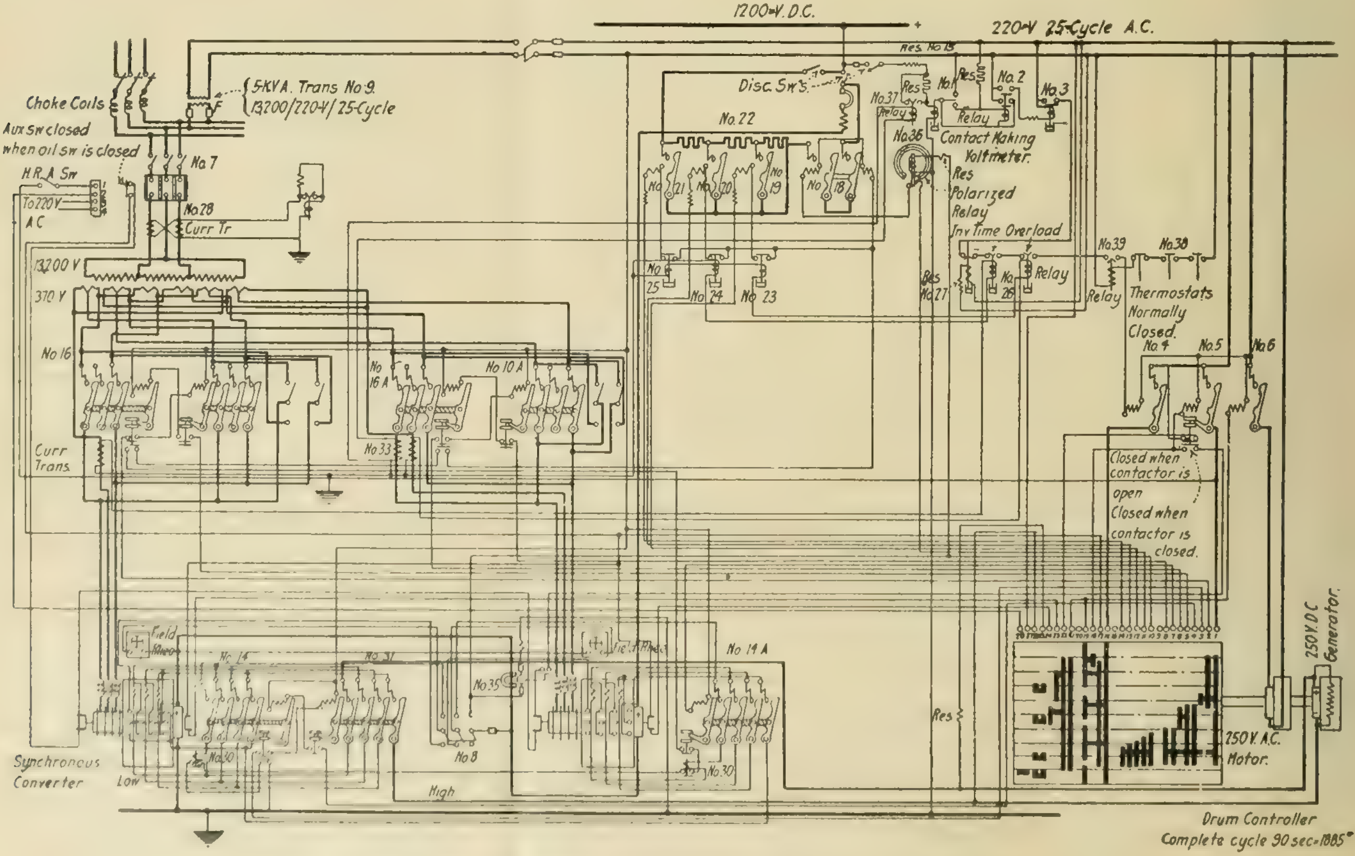
The operation of the automatic sub-station is protected against practically any trouble which might occur. In the first place, in starting up the machines and placing them on the line, if at any step in the operation the apparatus does not function, it is impossible for the next step to occur. Bearing thermostats on both the machines, set at 80 degrees C., will cut the machines off the line whenever the bearing temperature exceeds this setting. When the bearings have cooled down below this limit the thermostats will make contact, and the machines will again come in on the line, the cycle being repeated until the trouble is corrected. Three overload relays protect the machines against gradual overload. The first one of these is set at 500 amp., which is the full-load rating, and the other two have higher settings. As each cuts out it cuts resistance in series with the trolley circuit and thus limits the load. If an overload continues, a thermostat placed on the resistance grid and set at 60 degrees C. will cut the station out when the temperature there has exceeded this setting. A reverse-current relay on the direct-current side will shut the station down in case of machine trouble or opening of the alternating-current line. The low-voltage relay cuts the station out in case the high-tension voltage drops seriously or is interrupted. If the low-voltage relay should not work, in this instance the reverse-current relay mounted on one of the machines would cut the station out.

If there was an open circuit in the converter fields, the relays in the field circuits would open the circuit through the No. 18 contractor and the machine could not be thrown on the line, but would be cut off instead. After the machines are on the line, if the field circuit should open up in any way the machines would tend to run away and the overspeed devices would cut out the entire station. The control apparatus would then start to cut them in again, but could not get beyond the step in trouble. If the small direct-current generator should for some reason fail to excite the converter field, and the latter come up with the wrong polarity, the polarized relay would prevent the machine from being thrown onto the line. If the small generator failed and the rotary came up to speed with the right polarity, the operation would then go on and it would be thrown onto the line. In case of a dead "short" on the trolley, the overhead trip onto the main oil switch would operate, and would not come in again under automatic operation, because opening the oil switch from this source also opens a mechanically-operated switch, which can be closed only by hand. An overload relay connected in the alternating-current side of each converter is simply a check on the thermostat relay on the resistance grids. These also take care of the case where a gradual overload may not be severe enough to open the main oil switch, but too heavy to wait for the thermostatic cut-out to operate.

Toronto Railway Strike Happily Over

The trouble between the Toronto Railway Company and its employes, which resulted in a two and a half days' strike, ending July 13, at noon, was finally settled by an increase in wages of 6 cents an hour, coupled with the condition that the whole matter be submitted to a board of arbitration. The men had asked an advance of 10 cents an hour. There was no attempt on the part of the company to operate the cars during the strike, but in spite of that the public suffered less inconvenience than had been expected. The large number of motor cars in the city, practically all of which were placed at the service of pedestrians during the morning and evening rush hours, handled the situation fairly satisfactorily. The larger companies, for the most part, took care of their own employes, every kind of motor conveyance being requisitioned for this service.

The most noticeable feature of the whole situation was the reckless driving of the jitneys, which, relieved of the regulations imposed by the presence of street cars, and eager to reap as much of the golden harvest as possible, were responsible for a large number of accidents, most of them, fortunately, of a minor nature. As was to be expected, too, the "shark" made his appearance early in the day, and charges of at least a dollar a head are on record for a service which



Wiring diagram and equipment in 1200 volt automatically operated sub-station.

formerly, under street car competition, was gladly rendered for a nickel.

There was a noticeable absence of bitterness in the negotiations throughout, no doubt due largely to the fact that each side recognized the force of the arguments of the other. For the men there was the greatly higher cost of living, which secured respect for their demand for an increase, while for the company there was the increased cost of operation, maintenance, and renewal. There seems to be only one alternative—the public must pay. The unit fare in Toronto is very small, and, with the exception of the cost of electric current, is about the only thing the public buys that has not gone up in price. Of course, it is a great pity that a commodity so widely used could not be maintained at the old price, but the same is true of milk, bread, butter, and eggs, all commodities just as universally used, and to a much greater extent, than street cars, and yet at the first sign of increase in the cost of raw materials up go the prices to the consuming public. If the prices of these every-day commodities had been subject to anything like the same control as are the street car fares, the necessity for the increase in wages would never have arisen and the demand would never have been made.

We thus have a splendid example of the way in which a little innocent looking profiteering in one corner of our supply and demand network results in the entanglement of the whole of our social and commercial system. The street railway company, with the price at which it must sell transportation fixed by law, is in a difficult position, and it would not be surprising if the board of arbitration should recommend either that the rate of transportation be raised or the company be relieved of part of its percentage obligation to the city—the same thing, except that the latter alternative would distribute the added burden more uniformly.

One thing is certain, the company will not give service for which the public does not pay. If the system is operated at a loss to the shareholders the patrons will suffer. The question that must be answered by every citizen is: "Am I willing to pay two or three cents more a day, or would I rather put up with much poorer transportation service than I am getting at present?" Considering the value the average man now places on "two or three cents," there is little doubt of the answer.

Automobile headlight glare, which has been the subject of considerable legislation, has, in general, been treated in a very unscientific manner until very recently. Now, however, there is decided evidence of an awakening among technical men on this subject, and a better understanding of the problem to the end that satisfactory solution of the problem appears to be in sight.

Popularity of "Safety" Cars

The Electric Railway Journal estimates that there has been a slight falling off in the number of one-man cars placed in commission during the first six months of 1917, as compared with the same period a year ago. The figures given are, for the first six months of each year: 1915, 1,273; 1916, 2,224; 1917, 1,943. These figures cover both the United States and Canada. It can scarcely be argued that the figures indicate any diminution in popularity of this type of car, the falling off being explained rather by industrial conditions. It is also quite likely that a number of cars are being transformed by the companies themselves, and so are not included in the list.

The item states that there is a substantial increase in the number of lightweight cars, and that it is apparent that lightness and safety have at last been fully recognized by small, as well as large, roads. The Stone and Webster properties are quoted as having been the largest purchasers of the small, light, safety car.

"Made in Sherbrooke"

We are reproducing herewith photographs of the exterior and interior of the latest example of rolling stock put out by the Sherbrooke Railway and Power Company. This is a local product of the city of Sherbrooke, of which both the city and the railway company, and more particularly the superintendent of the company, Mr. F. X. Couture, should be proud. The car is 32 feet in length, has a seating capacity for 32 passengers, and standing room for as many more. It was described in detail on page 29 of our July 15 issue. It is built so that it may be operated either by one or two men. This seems a wise precaution in view of the rapidly growing popularity of the one-man or "safety" car, a popularity which is quite as evident with the riding public as with the companies themselves. Using this type of car it is possible, without increasing operating costs, to give a more frequent service. It has also been shown that the number of accidents following the use of this type of car has been considerably reduced.

Interior Sherbrooke car.

Exterior view Sherbrooke car.

The Dealer and Contractor

The Place of the Jobber in the Electric Trade—Manufacturer Ought to Protect Him—Need for Clean-cut Policy*

While nobody can dispute the fact that the man who buys only $5 or $6 worth of wire must buy it in a certain way, still there is considerable argument as to how the man who buys $100,000 worth of wire should do his buying.

Now, as the value of the wire itself is probably the largest single item in the electrical equipment of a building, with the exception of the labor, it pays the owner, the architect, and the wire manufacturer to spend a considerable amount of time on the proposition.

The feeling is fostered that the architect and owner of the building prefer to deal directly with the manufacturer, really ignoring the contractor, although he installs the wire, and totally eliminating the supply jobber. This condition complicates matters to a great degree and furnishes one of the jobber's most serious complaints, particularly in the East, against both the manufacturer and the contractor.

Their Own Electrical Department

On the other hand, a great many of the large industrial plants, because of their growth, have developed the habit of operating their own electrical department, which electrical department almost always expects to deal directly with the manufacturer, and this action seems, to a certain extent, to be justified by the size of their purchases.

These conditions all make for a lack of policy on the part of every individual connected with the transaction, and this lack of policy is made more disastrous in its results to the trade by the rapid fluctuations which are always taking place in the price of copper wire, which further complicates the situation and at times produces a condition of absolute demoralization in the business, during which time nobody makes money. This demoralization has been corrected by the extraordinary times which we have seen for the past year and a half; but we desire to most earnestly warn everybody connected with this industry that a return of normal business conditions will result in the most heart-breaking competition unless steps are taken by everyone concerned to stabilize the business now under the present conditions.

Cost Accounting

One of the essential factors in stabilizing business and preventing demoralization in price is establishing among manufacturers, contractors, and jobbers an accurate system of cost accounting. The lack of such a system lies at the foundation of destructive competition.

As I said before, we have given this matter very close and serious attention for the past two or three years. Many of the conditions above mentioned have borne upon us very severely at times, and we have seen conditions in the wire trade which we could only consider lamentable.

Blames the Manufacturer

I, personally, am inclined to criticize the manufacturer as being the cause of a great deal of the trouble. Upon accepting this conclusion, the natural outcome would be to brand our goods, advertise the brand, and endeavor to create a demand for it which would be treated along stable policy lines. While we have only gone a small distance along the line we propose to follow, the results are already extremely gratifying; and I desire to explain to you just what our conception of business is and how we propose to handle it.

So far as we are concerned, we do not regard wire as sold until it is actually installed in service—in other words, we feel that after we have made our sale to the jobber it is up to us to help him with the sale of the wire to the contractor, and after that we must help the contractor to sell it to the owner.

The Owner's Viewpoint

Every one of our policies, therefore, is carefully scrutinized from the owner's point of view. We believe that there is nothing in the long run that will prove so economical to the consumer as distribution through the jobber and contractor. You will note we say "economical"—not "cheap." We are now reaching a solution which will afford us a solid sales argument to the contractor, and which will strengthen and uphold his stand, thus putting your customers in a better and more satisfactory position, and making a source of more profit to you.

We believe, as we have said, that we are not far from solving this proposition, and when we have solved it, and have created a satisfactory market for our material with the contractor's customers, we have no doubt in the world that he will see the wisdom of dealing with the jobber, and that he will establish fair and satisfactory relations with him. We believe that within a short time we will see our business flow through regular channels.

Protect the Jobber

It is our intention to protect the jobber in every way possible. We realize that the jobber is severely handicapped in doing business by the necessity of carrying a stock, by the maintenance of a warehouse, and by the credit risk which he is absolutely obliged to take in the case of a large number of small customers, and for that reason we think the jobber should be protected by granting him a lower price than anyone else will receive who does not accept the same obligations. The same applies to the contractor, as he lightens his burdens by making the jobber carry a large stock and large force of salesmen, while he himself is carrying only a small stock and considerably less sales expense, so he, too, in turn, will be protected against the consumer who carries none of these burdens and who, consequently, must pay a profit to the contractor and to the jobber.

Quality and Service

It is our idea that "quality" and "service" are the two things which the owner of the building is entitled to have. We will furnish the "quality" and stand responsible for it, but it is up to the jobber and contractor to furnish the "service," and in order to furnish the maximum amount of service for the ultimate consumer it is our idea to give both the jobber and the contractor the protection to which they are entitled. We are of the opinion that this can be brought about in such a way that business will flow through these channels simply because it is easier and more economical. We are not in the least afraid we are not going to succeed in our policy, because we have already attained success, even though our policy is not as yet fully worked out in all of its details.

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*From address by E. W. Moore, president Electric Cable Company, before the National Jobbers' Association.

We do believe, however, that we should receive co-operation, and thorough co-operation from the jobbers. We do not want the jobber to go around and say that he handles two kinds of wire, one "quality" and one "cheap." This, we believe, is the way it is usually expressed. We do not think any jobber should handle anything but good wire, and this does not mean either that we expect all of the electrical supply jobbers in the country to sell nothing but our material.

Use Standard Wire Only

We do feel however, that no jobber should sell or buy any wire because it is cheap. He is neglecting his obligations to the public when he adopts this attitude. If he is now handling what is known as a "cheap" wire he should immediately investigate the supplier's methods, both manufacturing and selling, and make absolutely certain that nothing is neglected in inspections, and satisfy himself that the material is up to the proper standard. If he cannot make his manufacturer conform to a proper standard, then he should cut him out. The manufacturers should receive co-operation from the jobbers in working to the highest possible qualities. The "price" argument should be relegated to a secondary position, and the jobber should limit himself to selling on "quality" and "service" arguments. The customer should have what he wants and needs. Sometimes the "wants" and "needs" are not the same, and the salesman who keeps his mind on the "needs" is the one who wins out in the long run.

Recognize the Jobber

We cannot emphasize too strongly to the jobber the importance of driving every manufacturer to adopting a standard policy of recognizing the jobbers. This is the only sane policy in the electrical business, and if a manufacturer is not intelligent enough to adopt such a policy, then his selling methods are open to criticism, and when any of his methods are open to question his manufacturing methods are also under fire; and unless the jobbers throw their influence on the correct side in matters of this kind they are not doing their best for the industry.

In cases where we have secured our orders from the individual owner we propose to clear the order through the contractor who, in turn, we shall require to deal with our jobber in his particular district.

This campaign will be conducted by general magazine advertising, by personal solicitation, and in such other ways as may seem advisable from time to time. It will be accompanied by canvassing architects, engineers, lighting companies, and individual plants.

Systematic Retailing

Every effort will be made to decrease the competition business of each contractor and to increase their non-competitive business; to prevent electrical work being done by anyone but an established standard contractor; to force all retail business to the contractor; to have the contractor deal with the jobber entirely on all electrical lines, and to insure all stages of these transactions being accomplished with a reasonable profit.

The Jobber's Duty

So much for the general policy. Now as to the jobber's part. The jobber must accurately examine his cost of operation and sell no wire except at a profit. He must insist on buying and selling a "quality" article only. He must deal on prices based on the market, wherever possible, and he must adopt a policy and stick to it. Don't let a salesman who has been unable to sell a standard article come along and show his ability by talking you into using a cheap article which is sub-standard. Convince yourself that what you are doing is absolutely right, and convince your salesmen, and they will get you the orders, but make your policy and stick to it through thick and thin. A policy is not much good if it does not sometimes take a little courage to carry it out.

Two Reports of Interest to Contractors

Transmission and Distribution—Lighting and Illumination—Good Progress in Both

The various committees of the American Institute of Electrical Engineers recently made their annual reports, which are printed in the proceedings of July. Two of these are particularly interesting to central station operators, namely, that on transmission and distribution and another on lighting and illumination. We reproduce these in part herewith. The transmission report speaks of the trouble many companies have experienced during the last few years with high-tension insulators and the experiments that have been performed showing that porosity must be reduced to the lowest possible limit to prevent absorption, the joints must be so designed that the insulators will not crack with expansion and contraction, and that insulators must have ample margin of mechanical strength. The report also deals with the problem of the disposition of heat in underground cables.

The illumination report speaks particularly of the approximate realization of the quality of daylight in artificial illumination secured through the development of a special bluish bulb which, at some sacrifice of lamp efficiency, modifies the quality of light emitted by the gas-filled tungsten, resulting in a spectral distribution of the same general character as sunlight:

TRANSMISSION AND DISTRIBUTION

High-tension Insulators

During the last few years the troubles with high-tension insulators have become cumulative. During the summer seasons of 1915 and 1916 the failure of insulators on some long-distance transmission lines resulted so disastrously in the way of interruptions that it was evident something had to be done unless we were content to relegate long-distance service to the category of intermittent or second-class power. Particularly on the Pacific Coast these troubles had become acute. Some of our best engineers were already working on the problem. A number of the far western companies had clubbed together and employed the best talent they could find to carry on the investigation. Professor Ryan of Leland Stanford, Jr., University is now busy carrying out experiments on a very large scale to determine the effects of porosity in porcelain. All who are acquainted with Professor Ryan and his work know that his results when published will carry authority on this point. It was a great disappointment to us that the paper promised by Professor Ryan on the results of his investigation. to be presented at this meeting, had to be deferred a few months on account of extraordinary weather conditions, making it impossible to complete the data.

Professor Peaslee of the Oregon Agriculture College has attacked the problem from the chemical and microscopical point of view, while others have been investigating the effects of expansion and contraction of insulators on dielectric strength. The manufacturers of insulators have also been busy. This is shown in Mr. Austin's paper, presented at this meeting. The manufacture of high-tension insulators from fused quartz is recommended by Mr. Peaslee. It is hoped that someone properly equipped will pursue this line of investigation.

What has been accomplished? The last word has not been said on any of these lines of investigation and will not be said for a long time. So far as porcelain insulators are concerned we know (1) that porosity must be reduced to the lowest practical limit to prevent absorption; (2) that joints must be so designed and made that the insulators will not crack from expansion and contraction effects; (3) that insulators must have ample margin of mechanical strength.

Underground Cables

It is only within the last few years that users of underground cables have begun to realize the importance of disposing of heat due to copper and other losses. Conduit lines were designed fifteen or more years ago, with the idea that there would be from three to five watts lost per foot of cable. Even engineers seemed to have a sort of blind faith that these watts would get away somewhere, somehow. No one ever stopped to consider what would happen in case these watts did not get away. However, we have found out in the school of experience. The lesson has been costly, but it has been learned. It is scarcely exaggeration to say that as much skill is required to design a conduit line as to design a dynamo.

The problem is to dispose of heat. This may be done in two ways—(1) by minimizing the amount produced; (2) by quickly conducting away the heat that is produced. The first is largely the problem of the cable manufacturer. We have two papers this year which show great advance in our knowledge of dielectric losses. The use of certain insulating materials in saturating paper insulation greatly reduces these losses. This is well brought out in the papers by Messrs. Bang and Louis and by Messrs. Clark & Shanklin. The reduction in losses is not a small amount requiring laboratory tests to find. Cable ratings under some conditions may be more than doubled. These investigations are highly profitable and should be continued. The second point relating to conducting the heat away from cables after it has been generated has been brought out by Mr. Harper. No operating engineer can read this paper without a deep and sympathetic feeling of comradeship with the author. Most of the underground conduits now in use were built without any regard to their capacity to dissipate heat, and thereby immense sums of money have been thrown away.

Mr. Roper's paper on high-tension cable joints is the very highest authority on this subject, and is worth careful study. Probably there are more breakdowns at the present time in joints than in all the rest of a cable system. Practically all of these breakdowns are avoidable by carefully following the recommendations laid down by Mr. Roper.

Suggestions for the Future

For the future activities of this committee I suggest that it pursue the high-tension insulator problem. The work has been started, but there is much to be done. Investigations so far indicate pretty clearly where the weaknesses lie, and this is but one step from the solution of the problem. We suggest that further investigations be made on the subject of dielectric loss in cables, to the end that the laws governing it may be definitely known. It will then be possible for the manufacturer to give an even quality of cable with minimum dielectric loss.

We further suggest that the use of 20,000 or 30,000-volt cables be investigated. Some 20,000-volt cable is now in use in this vicinity, but we greatly desire to hear all about it.

LIGHTING AND ILLUMINATION

Progress in Electric Illumination

The marked progress in electric lighting in the past few years is founded largely on the reduced cost of luminous flux. The higher lamp efficiencies which have been realized in the newer electric lamps, together with the gradual decline in cost of power, have combined to cheapen luminous flux to such an extent that the average customer can with advantage sacrifice cost to a moderate degree in order to enhance to a greater degree the satisfactoriness of his installation. On this thesis may be explained, at least in part, the tendency toward higher illumination intensities, both indoors and outdoors, the more general use of indirect or partially indirect lighting systems, and the demand for so-called "filtered flux," as in the lamp which supplies luminous flux approximating daylight in quality, or as in the yellow lamp or the various kinds of tinted glassware.

It is not intended to leave the impression that the lower cost of luminous flux from electric lamps is uniquely responsible for this marked development in artificial illumination practice. Along with this growing economy must be considered the important progress manifest in the increasing appreciation of the value of the newer ideas of illumination and the equally important progress in developing the means by which these more highly developed ideas may be realized in practice.

Artificial Daylight

A few particular cases of progress may be mentioned. One of the more important of these is perhaps the approximate realization of the quality of daylight in artificial illumination, secured through the development of a special bluish bulb, which, at some sacrifice of the lamp efficiency, modifies by selective absorption the quality of luminous flux emitted by the gas-filled tungsten lamp, so that the transmitted flux has a spectral distribution of the same general character as sunlight.

"Flood lighting" constitutes another particular case of recent progress worthy of special mention. The application in the lighting of the Statute of Liberty is the most prominent illustration of this type of illumination but it is being used in the most varied ways, many of which have marked practical value. In connection with flood lighting may be mentioned the recent activity regarding projection lamps in general, and the present prominence of the question of automobile headlights and other searchlights.

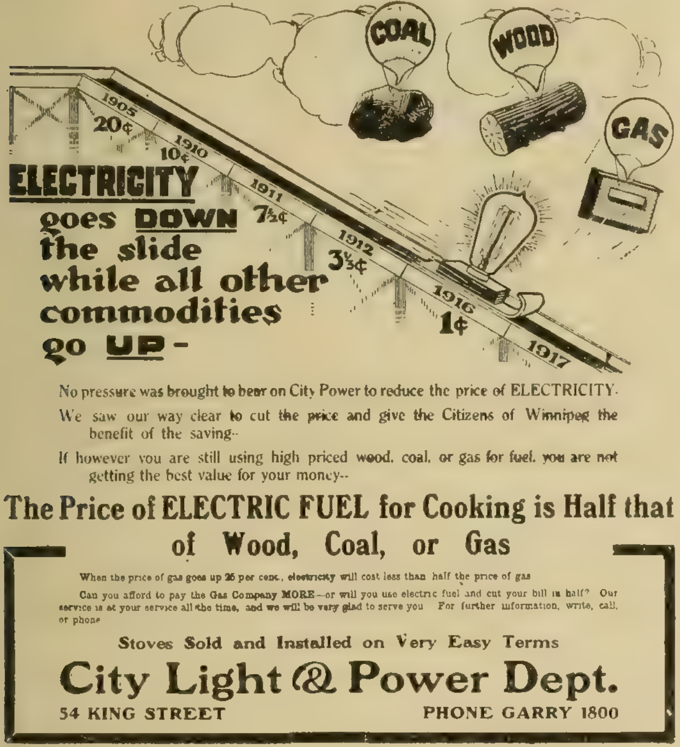
White Way Lighting

One other example of progress is to be found in the considerable increase in the use of ornamental "White Way" lighting for main business streets and ornamental boulevard and residential street lighting. This, of course, has resulted in a general revising of the standard of illumination throughout streets of lesser importance, but joining more or less closely the "White Way" districts. Along with the better lighting of business streets there is a gradual tendency to improve residence street lighting and to make better use of the light flux available on such streets by more rational subdivision of units and by utilization of light flux heretofore wasted for the lack of proper directing devices.

Do We Realize the Cheapness of Electric Current?

It is just possible that the contractor on his daily rounds, and the dealer as he passes electrical appliances over the counter, does not sufficiently emphasize the fact that while everything else which enters into our daily expenditures has increased in price during the last five years from 50 to 100 per cent., the cost of electricity has been reduced in even greater proportion. There are still many people who have the impression that electricity is expensive; that electric cooking costs more than gas; that electric light bills are high; that it costs a great deal to operate an electric fan, an electric iron, or an electric sweeper. As a matter of fact, many of these operations can be carried on almost without appreciably increasing the monthly bill, so small is the amount of current consumed.

The City Light and Power Department of Winnipeg illustrates this idea in a most realistic way in the accompanying advertisement, which appeared recently in local papers. The cost of electric current sure is on the toboggan slide, while everything else is soaring as only a balloon can, or at least could in the old days before present prices entered into the competition. Of course, the cost of current in Winnipeg is cheap, but there are many other places in Canada where the rates are comparable and where this type of advertisement is equally applicable. Central stations and dealers and contractors will do well to emphasize more frequently and more persistently the greatly reduced cost of electric current.


COAL
WOOD
GAS
1905
20¢
1910
10¢
1911
7½¢
1912
3½¢
1916
1¢
1917
ELECTRICITY goes DOWN the slide while all other commodities go UP -

No pressure was brought to bear on City Power to reduce the price of ELECTRICITY.

We saw our way clear to cut the price and give the Citizens of Winnipeg the benefit of the saving--

If however you are still using high priced wood, coal, or gas for fuel, you are not getting the best value for your money--

The Price of ELECTRIC FUEL for Cooking is Half that of Wood, Coal, or Gas

When the price of gas goes up 25 per cent., electricity will cost less than half the price of gas

Can you afford to pay the Gas Company MORE—or will you use electric fuel and cut your bill in half? Our service is at your service all the time, and we will be very glad to serve you For further information, write, call, or phone

Stoves Sold and Installed on Very Easy Terms

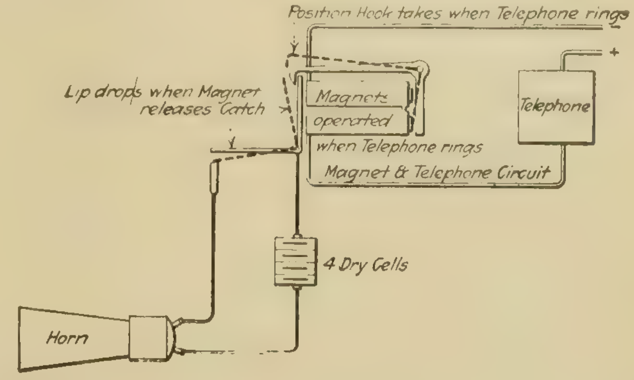
City Light & Power Dept.

54 KING STREET PHONE GARRY 1800

Automobile Horn, Operated by Telephone, Calls Men Out on Construction Job

There is usually a telephone on a construction job, and it is often a great bother to the timekeeper or material clerk to have constantly to go out on the job and find the superintendent or the person wanted to answer a call. If the calls are long-distance ones, the person must be summoned immediately. An easy way of getting out of the difficulty is described by a writer in Engineering News-Record. The trouble is easily solved by putting on the outside of the shanty a Klaxon automobile horn, operated by a push-button near the telephone. Give the men likely to be called a particular buzz, such as two short or three long. In this way they can be found in far less time and with far less trouble than by sending someone after them.

This scheme was adopted where the shanty was across a busy street from a ten-storey building that was being erected. In spite of the fact that there was much automobile traffic using similar horns in the street the distinctive call repeated a few times invariably brought the man wanted. The horn cost $2.50 second-hand, and required four dry cells for its operation.


Position Hook takes when Telephone rings
Lip drops when Magnet releases Catch
Magnets operated when Telephone rings
Magnet & Telephone Circuit
Telephone
+
4 Dry Cells
Horn

Electromagnet in telephone circuit automatically sounds horn when bell rings

Another arrangement, illustrated herewith, has a horn which automatically sounds when the telephone rings. In this case the office was situated on the hill and when the telephone rang the bell could not be heard unless someone were near it. An electromagnet similar to that ordinarily used in a call-bell was placed in the telephone circuit so that when the telephone rang the action of the magnet raised a latch that released a "lip," or drop. When this drop fell it automatically closed a circuit in which a Klaxon horn was wired up with four dry cells. This circuit, of course, would remain closed, and the horn would continue to sound until someone came and put up the drop. The general arrangement is shown in the sketch.

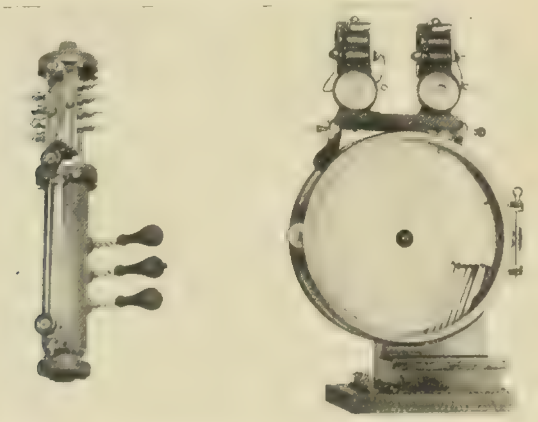
At night, and when there was no one on the work, it was a simple matter to disconnect one of the wires and break the circuit, eliminating the danger of exhausting the dry cells in case the telephone should ring when no one was there to put up the drop. As the work was down in the river bed and some distance from town, there was no chance of confusing the signal with other automobile horns.

Industrial Heating

The Westinghouse Type C oven heater is designed especially for use in enameling or japanning ovens, but may be used in a large variety of applications where ovens are employed for a baking or drying process. The heating element consists of a ribbon wound on a number of fire-clay bushings assembled on two steel tie-rods, between two pressed steel end plates. The ends of the ribbon are scured to drop forged steel terminals, which are clamped to the steel tie-rods, the rods, therefore, becoming the terminals for the heaters. These rods are insulated from the end frames where they pass through same, and the ends are threaded for bolting on the connectors. Connections are made of ⅛ in. x 1 in. cold rolled steel. A large number are made standard, and may be supplied directly from stock, along with the heater. Special connectors are furnished to meet the requirements. Cold rolled steel bus bars are recommended, and may be mounted directly above the heater on insulators bolted directly to the end frames. Connectors are secured to bus bars by steel clamps. Hooks are used for hanging the heaters on to the usual supporting steel work, which may be flat iron, angle or channel iron or pipe work. The hooks are bolted to the flanged end plates of the heaters. Protecting screens may be attached directly to the flanged end plates without any other means of support. Heaters may be mounted either on the side walls or on the floor and in any position. Heaters are normally rated at 2.5 kilowatts at 120 volts. Any number of these heaters may be installed in an oven and connected to any power circuit which may be normally supplied—single-phase, polyphase, 110-220, or 440 volts. On 220-volt service two heaters are connected in series, and on 440-volt service four heaters are connected in series. Where three-phase power circuits are used the heaters are connected three-phase, with the phases balanced. This heater is put out by the Canadian Westinghouse Company, Ltd., of Hamilton, Ont.

Conserve the Coal

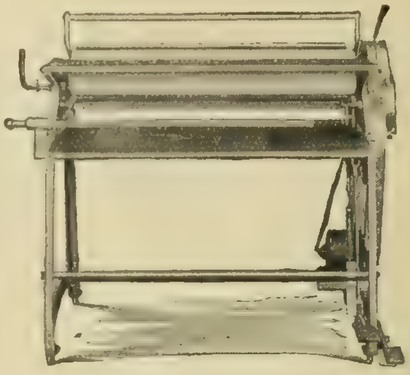
The coal shortage of last winter, and which still exists, coupled with the high cost, has made us alive to the necessity for fuel economies wherever possible. It is desirable that no one burn more fuel for any given purpose than is necessary. In the generation of steam many things are being done along this line. One of the most important improvements for controlling the economical use of fuel is an instrument recently invented for recording the level of water in boilers, that it may always be kept on the economical line, and, therefore, that it will only require the minimum quantity of coal to evaporate. The usual practice of depending on the eye of the water-tender, good man though he may be, is uncertain. The instrument referred to, and illustrated herewith, in no wise belittles the use of flow-meters or regulators, but it has a field all its own. It will appeal particularly to the owner and manager, officials who may either not be technical men or, if they are, are too busy to attend to the engineering details. They will not be able to keep control by an occasional glance. The use of this instrument will safeguard against loss in coal wasted due to too much water, insure against explosions and repairs from too little water, and show at every minute how nearly the point of greatest economy is approached. This apparatus, it is claimed, will record the water level correctly on the dial, and if the boiler is empty or full the alarm will ring and the lights flash. The bells and lights may be placed at the back of the boiler at the blow-off valves, and will give the same warning as on the recorder. The dial may be placed in an office, away from the boilers. As an example of the saving to be effected it may be stated that three inches too much water means a loss, at present price of fuel, of approximately $4,500 a year for each 100 h.p. J. D. LaChapelle & Co., 317 St. James Street, Montreal, Canada, are Canadian distributors for the manufacturer, the Wright Electric Recorder Company, Cleveland.



lectrical recorder, contact mechanism on the left.

Apex Domestic Mangle or Ironing Machine

The electric driven ironing machine developed by the Apex Appliance Company, 3,223 West Thirtieth Street, Chicago, will, it is claimed, iron perfectly everything in the average family washing except the most elaborately ruffled gowns and lingerie. For fine lace and embroideries it is claimed to be superior to the hand-iron, as the entire article is pressed at one time and there is no pulling or drawing. The principle upon which the Apex ironer operates is the same as that of the hand-iron except that the action is reversed. Instead of rubbing the iron on the goods the goods are pressed against the ironing surface. The polished ironing surface or "shoe" is curved so that when set in position its entire surface presses firmly against the padded roll which carries the clothing over the ironing surface. The shoe is heated by units which are located inside the shoe. These heating units can be either gas or gasoline burner or electric coils, as desired. They are arranged so as to maintain an even heat over the entire surface of the "shoe." All parts of the machine are metal, with the exception of the padded roll and feed board. The gears and belts are enclosed by guards. The machine is 47 inches high, and the roll is 44 inches in length. The machine is belt-driven by a Robbins & Myers motor. If desired, it can be equipped to operate from the washing machine motor.



Heavy Building Program

The Bell Telephone Company have decided on a building programme necessitated by the steady growth of the system. The following are brief details:

Contracts have been let and work commenced on a new central office building on Garfield Avenue, Hamilton. It is expected that the building and equipment will be ready for service about March of next year.

Across the road from the location of the existing office on William Street, Lindsay, work will commence at once upon a new central office building, to be ready for occupation towards the end of the present year.

Tenders are about to be called for a new central office building on Albert Street, Thorold, Ont.

Plans are almost completed for a new central office building to be erected in Notre Dame de Grace, Montreal, at the corner of Walkley Avenue and Sherbrooke Street. The building is expected to be ready for occupation about May 1st next.

Plans are being prepared and tenders will soon be called for covering the erection of a central office building at St. Hyacinthe. This will be a two-storey structure, and will be situated at the corner of Girouard and Laframboise Streets. It will be ready for service about April next.

A central office building on William Street, Smith's Falls, will be completed early next spring. Plans are now being prepared.

Fisher Electric Company Extending

Mr. E. McBride, formerly assistant to superintendent of distribution, Toronto Electric Light Company, and latterly superintendent of standardizing the change-over of the system from 60 to 25 cycles, has become associated with Mr. Fisher, of the Fisher Electric Company, 48 Brittain Street, to deal in new and second-hand equipment. This firm is developing at the present time from a local to a Dominion organization, and will establish connections from coast to coast.

New Factory for Fred Thomson Company

A contract has been let for a new factory for the Fred Thomson Company, Ltd., Montreal. This will be on Genevieve Street, of four storeys, 108 x 50, and of brick construction. It is designed for the purpose of building electrical motors, etc., and will have considerable space for storage purposes. The company propose to also utilize the present premises on Craig Street West.

The Ontario Safety League have recently sent out a number of bulletins. Two of them—Nos. 20 and 21—refer to electric railway operation, and picture cases in which accidents occur which could be easily avoided. No. 77 is an industrial bulletin, showing how an accident occurred through the failure of an employe to wear his goggles.

As a war-time measure in France it is proposed to create a new office of under-secretary of state, who will be charged with the task of developing and extending the use of France's resources in water-power. It is stated there is available a vast amount of energy which has never been adequately exploited, owing, principally, to complicated regulations concerning its application to industry.

New Book

How to Make High Pressure Transformers—by F. W. Austin, professor and head of the Department of Electrical Engineering, Thayer School of Engineering; second edition; 65 cents. The book consists of directions for designing, making, and operating high pressure transformers. 45 pages; 4½ x 7 in.; illustrated.

The illustration herewith represents a telegraph station in the trenches—Reproduced from a British magazine.

Trade Publications

Isolated Plants—The Main Electric Company are distributing Bulletin No 80, which comprises part of a report of the Carnegie Institute of Technology on one of the Main electric plants, which was subjected to a test in their laboratory.

Transformers—Bulletin No. 135, by the Packard Electric Company, St. Catharines, illustrating and describing the Packard line of transformers for lighting and power.

Carbon Brushes—A descriptive bulletin is now being distributed by the Calebaugh Self-Lubricating Carbon Brush Company, 1503 Columbia Avenue, Philadelphia, describing their No-spark carbon brushes for use on generators and motors. The growth of this company's business has been so great that, dating from August 1, their plant will be located at 1508-1518 Columbia Avenue; the office will still remain at 1503. The Electrical Equipment Company, Montreal, are Canadian representatives.

Personal

Mr. H. E. Howe, assistant to the president of Arthur D. Little Ltd., Montreal, has been elected a member of the Society of Civil Engineers. Mr. Howe is an authority on electro-chemistry.

Mr. F. X. Couture, recently appointed superintendent of the Sherbrooke Railway and Power Company, has been in the service of that company for twenty years, during which time he has risen from the position of carpenter to the highest office in the gift of the company.

Mrs. Elmer Williams (nee Miss Lena Worby), who has operated one shift of the Westbury Electric Light and Power Company's generating plant with perfect success for over four years, has resigned. Mrs. Williams is, we believe, the only woman operator in Canadian.

It has been announced by the United States Secretary of War that plants for the production of atmospheric nitrogen will be constructed immediately, at a cost of about $4,000,000, and that water-power will not be used. Sites have not yet been selected.

Toronto Hydro Annual Report

(Concluded from page 28.)

Another item of special interest, as indicating the extent to which the customers of the Toronto Hydro-Electric System are utilizing electrical appliances of various kinds is to the effect that over 18,500 articles were sold from the Hydro Shop (excluding lamps), an increase of more than 30 per cent. over the previous year. In this connection the report mentions that a branch demonstration sales office has been opened in connection with the new Carlaw Avenue sub-station, which provides facilities for the patrons of the system in the eastern section of the city.

The balance sheet now shows total assets for the Toronto Hydro-Electric System of $8,882,171, made up roughly as follows: Fixed assets, $7,501,186; stores on hand, $425,259; accounts receivable, $241,461; captal funds in hands of city treasurer and cash in bank, $710,141.

The necessary amounts have been set aside for interest, depreciation, and sinking funds, in accordance with the regular policy of the commissioners, which is to set aside out of earnings from year to year the following sums: (1) The amount necessary to meet all interest on the debenture issue for the purchase of the enterprise; (2) the amount necessary to constitute a sinking fund, which, accumulating at a given rate of interest, shall be sufficient to pay for the debentures at maturity; (3) the amount necessary to accumulate by the end of the life of the various items of the plant a fund sufficient to replace the same without making any further demands upon the city for new issues of debentures for replacing apparatus

Current News and Notes

Brantford, Ont.

The Lake Erie and Northern Electric Railway is now connected up with Lake Erie, the first car running into Port Dover from Brantford on July 14.

The by-law in Brant Township to spend $27,000 to introduce hydro-electric power into the city's suburbs was carried by a majority of 156.

Chatham, Ont.

Arrangements are being completed for a supply of hydro power for the Chatham and Wallaceburg Electric Railway. Power is now generated in Chatham, but it is anticipated that an improved service can be rendered with more power on the line.

Cookshire, Que.

Ayton Cromwell, contractor, Cookshire, Que., has been award the contract by the Westbury Electric Light and Power Company to construct a concrete dam across the Eaton River at their new plant.

East Angus, Que.

The Westbury Electric Light and Power Company have succeeded in obtaining an exclusive franchise with the corporation of the town of East Angus, Que., to supply electricity for light, heat, and power for a term of eight years. Domestic and commercial lighting rates are 7 cents per kw.h.

Edmundston, N.B.

Application to the government has been made by the Town Council of Edmundston, N.B., for a grant of $75,000, to be used in improving the aqueduct, sewage, and electric systems.

Fredericton, N.B.

The Maritime Electric Company, Fredericton, N.B., have obtained a charter; capital, $1,000,000.

Hamilton, Ont.

Jerome McCarty, an operator at the Dundurn sub-station of the Hamilton Hydro-Electric System, died recently, as a result of burns received while installing a new transformer fuse.

Joliette, Que.

Tenders are being received by the Town Council of Joliette, Que., for lamps and electrical equipment.

Montreal, Que.

The Clemens Electrical Corporation of Canada, Ltd., has been incorporated; head office, Montreal; capital stock, $50,000.

In connection with the conduit system the city of Montreal is adding two-thirds of a mile to the lighting system which has been in operation for some time in parts of the city. The latest section is on St. Lawrence Boulevard, from Craig Street to Sherbrooke Street, which makes a total of eight miles under the new system. Thirty additional lamps are to be installed in place of the present eighteen lamps.

Only one tender—that from the Montreal Light, Heat and Power Company, was received by the City of Montreal in response to invitations to bid for the supply of power for pumping purposes in connection with the aqueduct. The engineers who recently reported on this project suggested that tenders be asked for this purpose. The price of the Montreal Light, Heat and Power Company is $26.50 for primary and $24.50 for secondary horse-power, to be delivered at a central distributing point. For general distribution of not less than 250 h.p., at any point, the price is $27.50 and $25.50 for primary and secondary horse-power respectively, while for power at a central point at 11,000 v. the price is $25 and $23.50 respectively. Indications point to the hydro-electric portion of the aqueduct scheme being abandoned, owing to lack of funds.

North Battleford, Sask.

Mr. Caldwell, superintendent of utilities, North Battleford, Sask., recently spoke before the Town Council of Rosthern, endeavoring to interest them in the purchase of an electric plant which his city has for sale. Mr. Caldwell stated that they burned slack coal at North Battleford, which reduced their fuel costs by over one-half, or practically as low as crude oil.

Northport, B.C.

The Northport Power and Light Company, Northport, B.C., has been organized to supply light and power to the Nelson district. One of the directors is Mr. Lorne A. Campbell of the West Kootenay Power and Light Company.

Petrolea, Ont.

The Town Council of Petrolea, Ont., are contemplating a hydro pumping system to secure a supply of water from the lake.

Toronto, Ont.

Work has commenced on the extension of the civic car line on Bloor Street, Toronto, from Quebec Avenue westerly to Runnymede Road. A single track is to be laid on the north side of the street, thus allowing for future double track when required.

The Toronto and York Radial Railway Company have increased the wages of all their employes $10 a month. This covers the Mimico, Kingston Road, and Metropolitan lines.

Vancouver, B.C.

The Carter Electric Company, Ltd., has been incorporated; head office, Vancouver; capital, $10,000.

Victoria, B.C.

Municipalization of the Victoria section of the British Columbia Electric Railway, as an outgrowth of the recent strike, has been discussed by the City Council. Nothing has been made public as yet, but it is understood that it is not the intention of the city to deal with the province, but to endeavor to acquire and operate the street railway lines as a municipal institution.

Windsor, Ont.

The Moloney Electric Company, Windsor, Ont., are constructing an addition to their factory.

Winnipeg, Man.

Winnipeg Electric earnings for May, just published, were as follows: Gross receipts, $259,793; net earnings after operation costs are deducted, $64,144; net earnings after meeting fixed charges, $3,856.

The Westinghouse Lamp Company, New York City, announce the appointment of Mr. T. C. Whaling as General Manager of the Company to succeed Mr. Walter Cary, whose election as vice-president of the Westinghouse Electric & Manufacturing Company has just been announced.

Electrical News
Generation, Transmission and Application of Electricity

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The Place of the Engineer in National Affairs

It is a matter of constant comment and regret in engineering circles that engineers, in general, appear to take so small a part in national affairs. We say "appear" deliberately, for it is quite possible that the influence of the engineering mind on the trend of modern times is much greater than it seems on the surface. It must be remembered that an "engineer" has been a man apart and that engineering education in any form has been looked upon as something entirely inadequate and of a lower rank than, for example, the classics. At the same time, therefore, that he has been shaping, in no small measure, the progress of world events, he has been "living down" the prejudice with which he was surrounded, and almost smothered, at his birth.

That he is actually and gradually overhauling this unfair and unreasonable handicap is shown by the gradual change that is coming over the lay mind with regard to the value of an engineer's equipment and experience. He is now, occasionally at least, given the opportunity of demonstrating his value and the problems he is called upon to solve are more diverse. No one who understands the training of the engineer fears for the outcome. His mind is naturally constructive; his methods are synthetic, "building" is his chief aim in life. What better type could we develop to handle, in due course, the affairs of the nation?

Increasing Crop Production by Electro-Culture

In our June 15 issue we published the results of some British experiments on the increased production of crops due to electro-culture, but information regarding the necessary equipment and its installation was very meagre. We are pleased now to be able to add something to this information through the courtesy of the Electrical Review, of date July 6.

The method of distributing the charge to the crops as carried out at various experimental points in Great Britain has been much the same. A network of wire, or strands, barbed or plain, were stretched over the crops at a convenient height from the ground by means of high tension insulators and kept charged to a potential of about 80,000 to 100,000 volts. As network is generally inconvenient and expensive and barbed wire involves the use of heavy poles and large insulators, the choice usually falls on the plain wire. The density of an electric charge at any point on its body is proportional to the curvature at that point. That is, the potential would be greater as the curve is greater, and, therefore, the wires should have as small a diameter as possible. Wires of from 20 to 30 s.w.g. maintained at 90,000 volts appear to give the best results. This is just about the pressure at which corona appears and so, at this potential, it is possible to transmit, if necessary, without much energy loss so that all leads to the network may be of bare wire No. 10 or 12 s.w.g.

A network of fine wires may be used in a span of 150 feet with a sag of not more than 8 to 12 inches if silicium bronze or galvanized steel is used. It is better to keep the wires as low as possible, thereby intensifying the discharge. However, to avoid concentration on some plants which are higher than others, the distance between the wire and the ground should be at least equal to twice the height of the tallest full grown plant. It is also necessary to allow sufficient space for working under the wires, so that it would appear that a distance of 7 feet from the ground is about the minimum.

Methods of Producing High Tension Current

Three methods are in use for producing the high tension current with which the network of wires is charged: (1) static machines; (2) step-up transformers; and (3) induction coils. Of these, the coil seems to be open to the fewest objections. Wireless and X-ray work have produced so great a demand for these machines that they have now become thoroughly reliable and are available at a moderate cost.

According to the Electrical Review, the discharge appears to act, roughly speaking, as artificial sunlight, and, as it is quite possible to over-stimulate plants, judgment is necessary in determining how long to keep the discharge going each day. In damp, cloudy weather four or five hours per day would appear to be about right; a sunny day would require less, while in hot scorching sunlight, or in periods of very dry weather the discharge should be discontinued altogether. It will thus be seen that this method of culture appears to supply a means of counteracting lack of sunlight—a condition experienced, for example, at many points in Canada during the months of May and June of the last two years. Another useful effect of the electric discharge is that blight and insects appear to be destroyed. It is said that these are quickly cleaned from such things as beans and carnations, and so on, when attacked.

Morning and evening are the best times of application, particularly the morning, and, as the crops under this treatment draw more from the soil, both in moisture and food, it is necessary to supply more water and fertilizer.

Report on Montreal's Civic Lighting System

Mr. Arthur Parent, civic superintendent of lighting, Montreal, has presented to the Controllers the report of the department for 1916. He states that 22 arc and 88 incandescent lamps of 80 c.p. were installed during the year. On the 31st of December there were in service—arcs, 6.6/10 amp. magnetite type, 425 for aerial districts and 277 for underground districts; arc, 4 amp. magnetite 2,997; incandescent of 80 c.p., 784, and of 40 c.p. 364—a total of 4,847, lighting about 500 miles of streets and highways. During the year there was installed an ornamental lighting system similar to that on St. Catherine and Bleury Streets. This new installation was on Craig Street, Fortification Lane, St. James and Notre Dame Streets, and intersecting streets between McGill and St. Lawrence Boulevard. The installation consists of 91 6.6/10 amp. d.c. ornamental inverted arc lamps, mounted on special cast iron standards placed alternately on each side of the streets at an average distance apart of 125 feet. The total cost was $19,270. The concrete foundations and lamp standards for a similar system are now in course of construction on St. Lawrence Boulevard, from Craig to Sherbrooke Streets.

The lighting service in general had been good, except for a few interruptions due to circumstances beyond control, and the lighting companies had satisfactorily complied with the conditions of their contracts.

The Department had placed under its supervision the installation of interior wiring in buildings so as to connect with the cables in districts where underground conduits had been established. The by-law had been enforced in four districts and had been generally complied with by tenants and proprietors.

The aerial installations of the various operating companies had been expropriated in the completed underground districts of 1, 2 and 3. The amount of compensation had been fixed by arbitration and amounted to $81,700, or $26,180 less than was claimed. Most of the poles and wires had been removed.

The amount appropriated to the department was $326,775, of which $314,695 had been expended. The amount of money to be appropriated for the lighting of the city must necessarily increase as the city extended, and Mr. Parent suggests that a sufficient sum be set aside to improve the street lighting. Owing to the low foliage of the trees in parks and squares the present system, he states, is inadequate, the lamps having to be placed at a height of 22 to 25 feet and most of the light is obstructed. Mr. Parent suggests ornamental lighting by lamps mounted on standards at a height of 10 to 12 feet and fed by underground cables to replace the present system. In view of the increased work and the operation of the underground system it is asked that the staff be strengthened.

Electric Trucks Give Splendid Service in Delivery Work

By A. Jackson Marshall

Among the numerous fields of work now employing automotive transportation, the electric vehicle is daily proving itself from many points of view to be the wisest choice for practically every urban use. This is true now, perhaps more than ever before, since war conditions have greatly increased the cost of gasoline, and a great number of those who have not heretofore realized the economy and dependability of the "electric" are now appreciating the advantages which so many have long enjoyed.

That the electric truck is achieving splendid results in the field of delivery work is plainly shown by the following table, which gives the operating and maintenance costs of three electric trucks in shipping and delivery work under abnormally hilly conditions of a western city:

	Miles	Average miles per day
1 ton electric delivery wagon with nickel-iron batteries in service 46 months ...	26528	22.2
2 ton electric delivery wagon with nickel-iron batteries in service 39 months ...	18910	18.7
3½ ton electric delivery wagon with nickel-iron batteries in service 46 months ...	17140	14.3

Daily Averages for Month of December

	Month of December, 26 days		
	1-ton	2-ton	3½-ton
Mileage	26.84	21.5	15.615
Cartage	10.273	9.627	12.916
Current (4c per kw.h.) ...	.805	.86	.937
Number of marks (pkgs.)..	37.08	21.50	20.692
Weight in lbs.	4441.68	8310.115	14796.23
Weight per mark (pkg.) ..	119.786	388.535	715.057

The item "cartage" is the average earned per day by the trucks in dollars and cents and figures on the following drayage rates:

Up to 100 lbs. 25c per mark (package)—100 to 300 lbs. 35c.; 300 to 500 lbs., 50c.; 500 to 1,000 lbs., 75c.; 1,000 to 2,000 lbs., $1. Machinery rate $1.50 per ton.

Expenses for December

	1-ton wagon	2-ton wagon	3½-ton wagon
Wages	$75.00	$ 91.15	$104.50*
Garaging	20.00	27.50	35.00
Current (4c per kw.h.)	21.95	22.36	24.36
Repairs and renewals	0.00	0.00	50.00†
Tires	0.00	0.00	0.00
Liability insurance	4.16	4.16	4.16
Fire insurance	2.25	3.37	4.50
Interest on remaining principal	0.00	0.00	0.00
Depreciation (12 per cent.)	32.50	40.40	52.40
Total expense for month ...	155.86	188.94	274.92
Total earnings for month ...	256.83	250.30	335.84
Net earnings for month	100.97	61.36	60.92

*Wages include cost of helper when needed.

†Wagon was painted in November.

Totals to January 1st

	46 months	39 months	46 months
Original total cost of trucks.	$3,250.00	$4,040.00	$5,240.00
Wages	3,183.00	3,184.91*	4,658.12*
Garaging	990.00	1,072.50	1,610.00
Current	804.82	764.15	1,076.86
Repairs and renewals	907.14	912.40	1,099.46
Tires	492.91	451.86	552.16
Liability insurance	191.91	162.24	191.91
Fire insurance	103.80	131.43	207.60
Interest	274.58	288.22	244.59
Total expenditures	10,128.24	11,007.71	14,880.70
Total earnings	11,318.33	11.088.47	18,511.92
Surplus above all costs..	1,190..09	80.76	3,631.22
Average total cost per month to date	$182.03	$219.06	$261.98
Average total cost per mile	0.382	0.582	0.868

*Wages include cost of helper when needed.

I. E. S. Correspondence Convention

The Illuminating Engineering Society's Correspondence Convention which this year will replace the regular annual convention, will be inaugurated during September by the release of the following papers:

Presidential address—W. J. Serrill.

Report of Committee on Nomenclature and Standards—A. E. Kennelly, Chairman; C. H. Sharp, Secretary.

Illuminating Engineering Publicity—G. H. Stickney.

Economics of Large Building Lighting—C. L. Law and J. E. Buckley.

New York Department Stores—W. F. Little and J. F. Dick.

President Wm. J. Serrill's address, not being submitted for discussion, will appear in the Transactions of the Society issued about the first of September. The three papers and the report will be distributed in pamphlet form to anyone who applies for them to the Society at its headquarters, 29 West 39th Street, New York, N.Y. A general invitation is issued for written discussions of each of these papers to be printed with the names in the Transactions of the Society. Any of these papers may be presented before meetings of Sections of the Society during the month of September. They will be released to the technical press for publication in full or in abstract at any time subsequent to the 20th of September.

Other papers of this Correspondence Convention will be released in similar fashion during October, November and December respectively.

The Effect of Increased Coal Prices on the Cost of Producing Electric Energy

The N. E. L. A. bulletin of June quotes figures showing the percentage of the cost of production of electric energy which is chargeable to the item of coal alone. These figures were provided by ten different towns and cities in Missouri ranging in size up to 15,000 inhabitants; they are shown in Table 1. From these figures calculations were made showing how the percentages vary with the increasing cost of coal, supposing the expense and revenue to remain otherwise the same. These calculated percentages are given in Table 2. Considering, however, that other expenses have not remained stationary, but have increased in much the same ratio as coal, it is easy to see that the cost of producing electric energy, using coal as a source of heat, is very considerably greater than it was before the war. The hydro-electric plant has at least gained to the extent that coal prices have increased and, to a certain degree, also as regards labor in that the labor item in a hydro-electric plant is smaller than in a coal-steam plant. The arguments in favor of the fullest possible development of our water powers are thus growing stronger every day.

Table I.—Per Cent. of Fuel Costs to Manufacturing Costs and Gross Earnings

	Percentage Coal to Manufacturing Cost	Percentage Coal to Gross Earnings
Plant No. 1	69.0	15.4
Plant No. 2	51.9	17.2
Plant No. 3	67.3	21.2
Plant No. 4	49.7	13.4
Plant No. 5	62.5	13.2
Plant No. 6	60.6	20.3
Plant No. 7	52.1	17.3
Plant No. 8	64.9	29.0
Plant No. 9	56.4	31.8
Plant No. 10	45.7	13.4
Gross receipts		$378,048.00
Manufacturing cost		110,273.00
Coal costs		65,213.00
		Per Cent.
Manufacturing costs to gross receipts		29.2
Coal costs to gross receipts		17.2
Coal costs to manufacturing costs		59.1

Table II.—Per Cent. Increase in Manufacturing Costs, etc., As Coal Prices Advance, Other Elements Stationary

	Old Prices	10%	20%	30%	40%	50%	100%
Coal to mfg. costs	59.1%	61.4	63.4	64.9	66.9	68.5	74,3
To gross receipts	17.2	18.6	20.0	21.2	22.5	23.8	25.6
Amount increase	None	$6.521	13.042	19.563	26.085	32.606	65.213
Per cent gross to equalize the advance in coal..	None	1.72	3.44	5.16	6.90	8.62	17.2

Position of the Engineer in National Affairs

By H. W. Buck*

There has been much discussion concerning the position of the engineer in modern times, but conditions are changing so rapidly and points of view are undergoing such a fundamental evolution that it is well from time to time to review the relations of the engineer to his surroundings and to secure if possible the proper orientation.

The Accomplishments of the Engineer

The change and improvement in the engineer's position in the world in recent years have been so rapid as to surprise even those who were the optimists in the underdog days of the engineering profession. In the middle of the last century, when the engineering and technical schools began to be formed in this country by men of far-seeing vision, the classical scholars looked on askance and took pains to differentiate these upstart institutions from their own traditional schools of learning and to ostracize those who pursued the new courses by classifying the professions as "learned" and technical.

Times fortunately have changed. The engineering profession is coming into its own. To-day the engineer is being swept along by a tide which he himself has created with an irresistible force, and it is well therefore for the engineer to take his eyes off his work occasionally and to observe his constantly changing surroundings. A flood of scientific and technical accomplishments has swept over the face of the earth, revolutionizing life, commerce, and international destinies. Even the turmoil in which the world now finds itself can probably in the last analysis be traced to the over-acceleration of world affairs resulting from the work of the scientist and engineer.

In all this development period of the enginieering profession during the last century the engineer has worked his way along alone and in silence, so to speak, seeking his reward rather in the joy of accomplishment and in the realization of his dreams than in worldly recognition and accumulation. The very inherent greatness of the pioneers who have laid the foundations upon which we now build prevented them in a way from acquiring a more worldly position in affairs. This tradition, however, is not a virtue beyond a certain point, and the engineer by nature is too willing to give way to others. The time has come when he should take a more worldly position in the world which he himself has created.

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* President A.I.E.E. before the Institute.

Emerging from Classical Period

In our general relations to intellectual development we may consider that we are just emerging from a classical period where tradition, custom, prejudice, ignorance, and dogmatic religion were the controlling forces. Movements which took place in world affairs were largely political, following the paths best suited to the advantage of the ruling classes. There was little real progress, because there was no development of scientific knowledge and its application in engineering. Scientific truth held no standing. The worship of tradition caused a powerful reaction against any scientific discovery which might necessitate a readjustment of established habits of thought and life.

For centuries before the dawn of the scientific and engineering era great changes took place throughout the world, but little real progress occurred. Races rose and fell, always falling back to the starting point, for there can be no upward trend in racial development without the solid basis of scientific knowledge to grow upon. China made great progress and developed its early civilization under scientific activity, but during recent centuries it has lived under the worship of classical tradition and has become inert.

A constant change in point of view, which is so largely brought about through developments in scientific knowledge, seems to be necessary for progress in civilization. Our civilization today differs from that of a century ago in proportion to the scientific and engineering evolution which has taken place during the period through its reactions on life in all of its phases. Such discoveries in science as the law of gravitation, the evolution of species, the laws of electromagnetic induction, etc., have probably had a more profound effect upon the development of the human race than any other acts in history.

The Engineer in Human Affairs

The engineering profession has passed through the preliminary stages of its growth and has reached a position where the engineer should work and act not only with proper attention to his work itself, but with full consciousness of the important relation of his work to human affairs in general. Among the early pioneers in engineering were many notable instances of men of great breadth of view. Specialization had not at that time begun to work its narrowing influences. Of recent years, however, under the stress of commercial development and economic conditions, increasing specialization has taken place and the engineer has become obliged to compass his mind with an ever-narrowing horizon. This specialization produces extraordinary proficiency in particular fields, but has the objectionable effect of narrowing the character and outlook of the man and of reducing his value as a citizen. We must take care lest commercial considerations and the modern mania for efficiency in the narrow sense force our engineers to lose sight of the world around them in their concentrated attention to the part rather than to the whole. This excessive specialization is a danger which threatens the future standing of the engineer.

It is interesting to recall in this connection the results of a recent canvass made by a joint committee on education on the qualities which, in the opinion of about 5,000 leading men, engineers and others, best fit a man for a successful career as an engiineer. As a result of this vote only thirteen points out of a hundred were assigned to purely technical knowledge as an essential, the other eighty-seven points being allotted to broader qualifications, such as judgment, character, human understanding, etc. This is merely a quantitative statement of the many general demands now being made of the engineer, and it illustrates how his work has broadened out. It is an interesting and encouraging symptom.

A most significant movement of recent times in the engineering world has been the development of co-operative action among engineers of all classes, and this tendency will, I believe, serve to offset the evils of specialization. It is the growing recognition of the fact that all branches of engineering are interdependent. We electrical engineers, I believe, are well aware how much we need the assistance of other branches of engineering for the successful fulfillment of our purpose.

The Engineering Council

This co-operative movement has quite recently been given tangible expression in the formation of the Engineering Council, an act, I believe, of far-reaching consequence. Under this organization as a beginning the Civil, Mechanical, Mining and Electrical societies, together with the United Engineering Society, are tied together for co-operative action through a joint body of twenty-four representatives. This body will meet at frequent intervals and will deliberate on matters of general interest to engineers. It is an encouraging beginning toward universal co-operation among engineers in all branches of work.

In this Engineering Council we have for the first time an engineering body representing about 30,000 engineers of sufficient scope and standing to create an engineering public opinion. Its influence is likely to be far-reaching in building up the prestige of engineers in both technical and civil affairs. A further development which has reached full recognition only in recent times is the mutual appreciation which has grown up between the engineer on the one hand and the worker in pure science on the other.

The engineer looks to the scientist to provide him with raw materials of knowledge with which to work out his application, and the scientist must look to the engineer to make his discoveries so fruitful that the full effectiveness of his work on the frontier of research can be sustained. Both are working together in order to unfold nature in the most effective way for the benefit of man.

We electrical engineers, I think, feel a particularly close bond with the pure scientist in that recent developments in physical science have disclosed an intimate relationship between electrical phenomena and the nature of energy and matter.

All of the important movements taking place at the present time which center around the engineer and his work mean, I believe, that the engineer is soon going to leave his position of isolation in independent fields of work and realize that he owes an obligation to the community broader than his daily engineering work and will contribute to the general welfare his talents and experience. It matters not whether the problems before him are political, sociological, industrial or technical, I believe that the engineering type of mind, if the proper breadth of view has been acquired, is best fitted to undertake them.

Resourcefulness and Imagination of the Engineer

It is not necessary, perhaps, in important administrative positions to have civil, electrical or mechanical engineers as such, but we do need men in those positions who have had training of the type which engineering gives, with the mental balance, the power of analysis which such a training develops, the resourcefulness and the faculty or recognizing and properly apportioning the various elements in a problem. There is a quality of mental honesty which engineering experience highly develops which is sorely needed in public life. The scientific and engineering professions should rise up and furnish such men from their ranks for the welfare of the country.

The classicist contends that a world dominated by scientists and engineers would be cold, materialistic and atheistic, and lacking in those qualities of art and sentiment and the imaginative outlook which every civilization so highly prizes. To this doctrine and its injustice to the engineer I want to take emphatic exception. The world today may be inclined toward materialism, but it is not dominated by the engineer—far from it—but by other classes.

The engineering mind, on the other hand, numbers among its characteristics a highly developed creative imagination and possesses to a high degree exactly those qualities of mind and temperament best suited to combat materialism. There have been many instances in history of great artists who have been great engineers and vice versa, and I believe that the two temperaments lie in close relationship. Furthermore, scientists and engineers as a class have a strongly developed spirit of international understanding and sympathy which may serve as an important safeguard against excessive nationalism and excessive aggression as well.

And so, gentlemen, I believe that we can confidently look forward to a new era for the proper fulfillment of the destinies of the engineer. Out of this world chaos we now see men of engineering and scientific training rising to positions of commanding prominence on all sides. It is simply the working of the inevitable law of the survival of the fittest.

In this great movement not only must the individual engineer play his part, but the great engineering societies must realize the power of influence which they are developing in an ever-increasing degree in the community at large and the obligations which devolve upon them.

Immediate Possibilities in the Development of Electro-Chemical Industries

The important position already occupied by our electrochemical industries is probably not sufficiently appreciated. Though comparatively in their infancy and of somewhat small dimensions, they include many of the basic requisites in the development of our larger industries, without which the latter would be quite impossible. Speaking before the Western Society of Engineers recently, Mr. F. A. Lidbury, manager of the Oldbury Electro-chemical Company, of Niagara Falls, outlined in more or less detail the more prominent of the electro-chemical industries, their relative importance, power requirements, and the reasons for their existence in certain localities. The speaker's remarks referred more particularly to the United States, but are almost equally applicable to Canada, and are specially interesting as denoting the trend and the extent of the development of these industries by our neighbors to the south. Mr. Lidbury's address was of considerable length, and only extracts are given below:

Electro-chemical industries, roughly speaking, can be divided in one way into three classes. First of all, the class which you could not turn out of this country if you tried to; second, the class that has grown up here in this country sometimes to as great an extent as is necessary, and sometimes not, and is still continuing to grow within certain limits. This second class of industries are those which depend upon favorable conditions, and to a great extent that means favorable power conditions, for their continued growth and existence in this country. The third class will be that group of industries which has not yet found a footing in the country; and we will also include in that class those industries which have not sprung into existence anywhere, but which the future will surely produce.

Copper Refining

Now, taking the first class, we will find that the first electro-chemical industry there and an extremely important one, as electrical engineers in particular know, is one that you could not get out of the country, whatever you did to it, and that is copper refining. I think that we can omit any discussion of this particular industry from our subject to-night without losing anything, because it does not bear on the general principles that I want to talk about. It is here because this is a great copper-producing country, and the question of power in copper refining and in certain other allied industries is of such a relatively small nature that it is entirely overshadowed by other conditions, principally transportation conditions and conditions regarding interest on the money that is tied up in the very expensive stuff one is handling and refining. So, though this is perhaps as important a single electrochemical industry as there is, yet the electro-chemical portion, in so far as that relates to power supply, is a very minor factor.

The industries that have sprung up in the country in the last twenty-five years can be grouped again, roughly speaking, in accordance with their size as power consumers. One finds oneself in a somewhat difficult position discussing a lot of these questions at the present moment, because though a couple of years ago it would have been relatively easy to pick an electro-chemical product and show the requirements of the country in this particular product as equivalent to so many thousand kilowatts, one cannot do it to-day, because many of those industries have received considerable stimulation from the conditions now prevailing, perhaps not so much directly a war stimulation as a stimulation which has been due to the general increase in business. And it is a matter that I, for one, would not pretend to decide, how far that increase in demand, and in some cases of production, in these particular industries, should be regarded as something that is bound to show a drooping curve in the next few years. That circumstance will make it necessary for me to give you figures with very great reservation, and not attempt to get close to the actual mark; though, as I say, a couple of years ago one could have given them very much more closely and a good deal more definitely.

Big Power Demand of Aluminum Industry

We find that perhaps easily first of the single electrochemical industries in point of power requirements, and also in point of value of product, is the aluminum industry. As far as one can make out, there are something like 130,000 kilowatts of capacity installed in this country at present for the purpose of making aluminum. Not all of it, however, is in operation, because of conditions, particularly at Niagara Falls, to which I will not refer just now. There are, as far as we can make out, about 60,000 additional kilowatts either being installed at present or contemplated, and this indicates the requirements of the aluminum industry alone in this country as somewhere between one hundred and two hundred thousand kilowatts. Now, no one, I think, can put a definite and arbitrary limit on the growth of that particular industry. The demands seem to be increasing every year. And those demands are not, to a very great extent, war demands, but the increased demand has also come about by the rapid extension of the general uses of aluminum, as, for instance, in the automobile. Its use in the automobile is not only direct, but indirect, and includes the manufacture of certain elements of alloys, which are constituents of the modern high-speed steels and of steels of a nature which enables small, light parts to be used in places demanding great strength in the automobile, where a few years ago a carbon steel of much greater dimensions had to be used.

The Ferro Alloys, Etc.

Next in line, and in point of size, we come to a group of compounds which cannot very easily be separated from one another—the ferro alloys, including ferro-silicon, ferro-chromium, ferro-molybdenum, and so on. It is a little difficult to put a figure to the power requirements of this class. I think somewhere about 100,000 kilowatts would come near the mark.

The next in size is probably calcium carbide, which may take 30,000 kilowatts or more. The calcium carbide industry is not growing to-day at the same rate as a few years ago. The use of calcium carbide for illumination is not so great. But, on the other hand, the use of acetylene for welding, and so on, is increasing, and is to-day, from an engineering point of view, by far the most important use of calcium carbide.

Artificial abrasives are the next in point of size, and I think some twenty to thirty thousand kilowatts—perhaps a higher figure would be nearer the mark—would represent the necessities of this country in the manufacture of fused alumina and silicon carbide, which constitute the basis of all modern grinder work.

Then we have the electrolytic alkali business, which gives us caustic soda or caustic potash, and chlorine in the form of bleaching powder, liquid chlorine, or other chlorine products, for which again perhaps 30,000 kilowatts would be a reasonable figure to take for the requirements of the country.

Then we come down to the manufacture of chlorates, which are used in the match industry, in the textiles, for the manufacture of oxygen, and in certain chemical operations. That might be put as consuming about 10,000 kilowatts. And, again, sodium, which, of course, is not much used in its original form, but from which is made sodium peroxide, used in the textile industries as a bleaching agent, and which is still more important as a starting point in the manufacture of sodium cyanide, will take up perhaps 15,000 kilowatts.

Then there are a number of minor articles, such as phosphorus, carbon bisulphide, and other products of the electric furnace or of electrolytic processes which might include one or two thousand kilowatts each. And, of course, if we wanted to go into the really small processes, there are numerous little units working all over the country on this, that, or the other special branch of electrolytic work which may take anywhere from a few kilowatts up to a few hundred.

From the consumptive point of view, then, I have given you the actual position at present of the industries that have grown up in this country in the last twenty-five years and now constitute, as I wish to point out to you very emphatically, the absolutely indispensable source of materials without which we to-day could not get along.

Indispensability of Electro-chemicals

I do not know how I am going to begin to give you any idea of their indispensability. Starting with aluminum, many of you know as much about its uses as I do. It has come into very large use in a considerable number of ways, and we would not like to get along without it. It forms, at any rate in combination with small amounts of other elements, alloys combining strength with extreme lightness. And those of you who have followed, for instance, the tendencies in automobile construction are aware of the extent to which the advances in the last few years in the ways of combination of lightness with power and performance have depended upon the use of this material. I have pointed out already the extent to which this material is used in the manufacture of high-grade steels which have become indispensable for mechanical operations, cutting, and so on, and also indispensable to structural purposes where extreme lightness and strength are necessary.

When we come to the ferro alloys, the same remark applies. And in the case of one of them—ferro-silicon—one gets a very good instance of how indispensable the products of the electro-chemical industry are. About 70 to 75 per cent. of all the steel that is made in this country to-day is made in the basic open-hearth furnace. And all of that steel, in its manufacture, requires the use of ferro-silicon. No ferro-silicon, no open-hearth steel. And with the conditions facing the steel manufacturers in these times, that means a very serious diminution, an extremely serious diminution in the steel output of the country, and on top of that, I think I could safely add, an extreme diminution in quality. In other words, the whole of the steel industry of this country is at the present time dependent, and, so far as we can see, always will be dependent, until something comes up to replace it, upon the single article—ferro-silicon—made in the electric furnace, by the application of electric power to the simplest and cheapest of all materials, namely, carbon, iron oxide, and silica.

Artificial Abrasives

The artificial abrasives, again, give you another line on the extreme importance of those industries to the general industries. The automobile, at any rate, gives you an idea of the extent to which modern mechanical operations depend upon the use of grinding wheels. Now, the grinding wheel of the newer or artificial abrasive is a different proposition from the grinding wheel of the natural class in two respects: Firstly, the material is better fitted for the job that it has got to do; and, secondly, being an artificial material, it is under better control in its manufacture, and it is possible to get a far greater degree of uniformity than in the use of the natural product. It takes rather an academic point of view to make the comparison to-day, because there is practically no natural abrasive material available here. Before the war about 60 per cent. of the abrasives that were used in this country were artificial abrasives—electric furnace products—the remainder being natural abrasives, chiefly coming from Turkey and Greece. Of course they come from those sources no longer. So, in a time like this, we are in any case entirely dependent upon the artificial abrasives. But whether that were so or not, it is still the fact that the modern technique of grinding and all that that implies—and you engineers know better than I do what it does imply—would be impossible without the use of the artificial abrasives, which the electric furnace has given to the world The use of the grinding machine has grown and extended tremendously, and its use as a serious factor in mechanical operations dates from the time when artificial abrasives began to be used.

I do not think I need go into detail in regard to the numerous other products that I ran over. If you get a rough line on the thought that I have just been trying to give prominence to, you will see how, though the aggregate output of the whole electro-chemical industry of the country may not, if reduced to figures or anything of that kind, look like a thing that could be regarded as of absolute importance to the country, yet, when you come to examine the indispensability of those products (and what I have said in regard to the products that I have mentioned applies to numerous other products as well, which I have not gone into for considerations of time), it is clear that the electro-chemical industries of the country are of extreme importance to practically every one of the basic industries of the country.

Some Concrete Examples

I know of no way of illustrating that better than taking an automobile and looking over its construction, looking over the materials employed therein, to find out to what extent those materials, and the application of the methods used in the manufacture of the automobile, depend upon electro-chemical products.

The American Electro-chemical Society got up an exhibit to indicate this at the last Chemical Industries Exposition in New York, and displayed a list of products used, either in the manufacture of materials used in the automobile or in the tools used, such as high-speed tools for cutting and grinding. And from each of those placards were strung different colored ribbons running to the portions of the automobile in which the particular products were used. And the automobile was a veritable mass of ribbons. You could hardly see the automobile for the ribbons.

Take grinding, for instance; there is hardly a single portion of an automobile from one end of it to the other that has not got to be ground in some form or other. There is not a single bit of steel in the automobile, from ordinary steel stampings and that kind, that is not dependent upon the electro-chemical industry for ferro-silicon. There is not a single one of those parts which have been lightened up so much in the last few years that is not dependent upon the existence and use of ferro-chromium, that is now so widely used. And we could go from one end to another of an automobile and talk the whole evening on it. I was told by a manufacturer at Detroit that the use of the alloy steel alone has reduced the weight of a 4,400-pound automobile to 2,200 pounds, made it infinitely safer and at the same time reduced the cost. That was one of the elements that had permitted of the reduction in cost, which has been such a feature of automobile construction in the last few years.

Again, without the use of the high-speed tool steels, which the products of the electro-chemical industries alone permit, without the use of the grinding wheels which the electric furnace has given to the world, a plant which can manufacture and turn out 500 cars a day would only find it possible to turn out a little more than a hundred—possibly not as much as that—with the same outfit and the same men. You will get an idea, therefore, of what the electro-chemical industry indirectly has permitted the automobile industry to do in the way of cheapening the cost. And it is safe to say, taking all these things together, and others that I have no time to mention, that if it had not been for the growth of the electro-chemical industry in the last fifteen or twenty years, and the application of its products to metallurgy and to the mechanical industries, the automobile, as we know it to-day, could not possibly have existed.

I will give you one other little illustration: Without high-grade ferro-silicon, which is 75 per cent. to 95 per cent. silicon, it would be impossible to manufacture those high-silicon steels which are now exclusively used for core work in electrical apparatus. I cannot begin to enumerate the results of that application, but one of them can be stated baldly in this fashion, that it has permitted the reduction of losses in static transformers to a point where they are now 50 per cent. of what they used to be. That, and that alone, has permitted that reduction. All over the industrial fabric of this country you find these electro-chemical products working their way and permitting advances in industry, advances in manufacture, out of all proportion to the importance of those products themselves. And I did not want to begin to approach my actual subject to-night without having said these few words to give you an idea of what is the general importance of the electro-chemical industry to the country.

Fixation of Nitrogen

So far, I have left one class out altogether, and that is the class of electro-chemical products we do not at present manufacture in this country. And among these the most important are those involving the fixation of atmospheric nitrogen. Now, the fixation of atmospheric nitrogen is, in short, this: Nitrogen exists in the air in an elementary condition. Four-fifths of the atmosphere is nitrogen. But in that form it is of very little industrial value. Before we can utilize it for industrial or agricultural purposes—and its application is principally an agricultural one—we have to combine it, either with oxygen, the other constituent of the air, or with hydrogen, which we can obtain in various ways, to give us nitrates or ammonia salts, or else with calcium carbide, a product of the electric furnace, to form cyanamide. Now, in those forms the nitrogen becomes a valuable manure.

The production of fixed nitrogen compounds by electro-chemical means has grown to a considerable extent, particularly in Norway, in France, in Switzerland to some extent, and also in Germany; also, I may add, in Canada. But we have never been able to introduce it into this country.

There are, of course, a number of electro-chemical products that I have not mentioned, some of which are considerable power consumers. Some are of local interest only. For instance, a great deal is being done to-day in the application of the electric furnace in the refining of steel and in steel castings.

In regard to the growth of electric furnace steel for steel casting work, that is, again, a more or less local matter.

Useful Data on Electric House Heating

We reproduce herewith some data taken in connection with the heating of the operators' houses at the plant of the Laurentian Power Company, Ltd., at Seven Falls. For these most interesting figures we are indebted to Mr. James Ruddick, manager and engineer of the company.

These houses, of which there are six, are built in a terrace. They are frame houses, covered with one inch rough boards, two layers of tar paper and clapboarded outside, with shingle roofs, and plastered inside. The foundations are of concrete, built high enough to form a basement approximately 4 feet 6 inches high.

The system used for heating is of the hot-air type. The air ducts and registers are precisely the same as those used with the ordinary hot-air furnace, the furnace being replaced by electric heaters, which are placed in the basement, in the centre of the houses.

The apparatus for heating, which was designed by Mr. Ruddick, consists of two iron boxes 6 feet long and 2 feet square, made of No. 10 gauge iron, lined with ½-inch asbestos lumber. Each box contains 18 grids, made of No. 14 Advance resistance wire, mounted on porcelain knobs, which are fixed to iron frames made from 1-inch by ½-inch iron.

These grids are so arranged that they can be connected in closed delta and open delta, on a three-phase circuit, or one leg on a single-phase circuit, or two legs in series on a single-phase circuit.

The power is 550-volt, 3-phase, 60-cycle. Each unit takes a maximum of 50 amperes. Air is forced through the grids into the air ducts by an 18-inch disc fan mounted on one end of each box, and capable of delivering 2,000 cubic feet of air per minute each. This apparatus has been in use for two winters, and has given entire satisfaction to date.

The figures given herewith were taken last winter, the temperatures for the inside of the houses being taken from the end house, which is farthest away from the heaters. Neither double windows nor storm porches were used, and, generally, the windows were open at the top. The total cubic capacity of the houses is 46,688 cubic feet, the basement and space between eaves and top of the roof being neglected. The cubic capacity of the basement is, roughly, 16,000 cubic feet. The temperature in the basement was between 32 and 45 degrees.

In addition to electric heating some heat would be derived from the kitchen stoves, which were used for cooking only, and would therefore be burning for a very small portion of the time.

In summer months the electric fans are run with the heaters off, thus supplying air to keep the houses cool.

From the figures given it is evident that the installed capacity is about 2 watts per cubic foot, and the maximum used, averaged over an extended period, is about 1.7 watt hours per cubic foot. Very severe outside temperatures are indicated in the column headed "minimum," where, it will be noted, the figures may refer either to temperatures below or above zero. The reader will understand from the next column, which gives the range. The inside temperature was evidently fairly uniform and, for the most part, quite satisfactory, as only in a very few cases did it drop below 68. The average consumption works out at 1.049 watts per cubic foot per hour.

Table showing actual operating figures from Feb. 17 to Mar. 31

Date. Feb.	Reading Time.	Time interval. Hours.	Meter Readings.	Diff.	Kw. H.	Kw.	H.P.	Watt hrs. per cu. ft.	Temp. outside. Max.	Min.	Range.	Temp. inside.	Weather.
17	4.15 p.m.	....	0193675	....	....	...	....	...	21	17	38	75	Fine
17	7.05 p.m.	....	0194130	455	227.5	80.3	107.8	1.72	21	17	38	75	Fine
18	7.45 p.m.	24.67	0196750	2620	1360.0	55.2	74.0	1.18	34	18	16	69	Fine
19	8.10 a.m.	12.42	0198070	1320	660.0	53.2	71.3	1.14	10	23	33	58	Fine
19	10.00 a.m.	1.83	0198280	210	105.0	56.3	75.5	1.21	10	23	33	70	Fine
20	8.34 a.m.	22.57	0201450	3170	1585.0	70.2	94.1	1.51	17	13	30	71	Snow
21	7.20 a.m.	22.77	0205010	2560	1280.0	56.2	75.3	1.21	18	6	24	69	Fine
21	9.42 a.m.	14.37	0205620	1610	805.0	56.2	75.3	1.21	18	6	24	70	Fine
22	7.20 a.m.	9.63	0206680	1060	530.0	55.0	73.7	1.18	21	20	41	68	Fine
22	1.00 p.m.	5.67	0207420	740	370.0	65.3	87.7	1.40	21	20	41	74	Fine
23	8.17 a.m.	19.28	0210050	2630	1315.0	68.2	91.4	1.46	25	16	41	72	Fine
23	1.10 p.m.	4.88	0210500	450	225.0	46.0	61.7	.98	25	16	41	71	Fine
24	8.48 a.m.	19.63	0212700	2200	1100.0	56.2	75.3	1.21	36	19	17	74	Windy
24	6.55 p.m.	10.11	0213440	740	370.0	37.6	50.4	.81	36	19	17	71	Windy
24	9.50 p.m.	2.92	0213760	320	160.0	54.8	73.6	1.17	36	19	17	70	Windy
25	9.38 a.m.	11.80	0215540	1780	890.0	75.4	101.2	1.62	0	28	28	70	Fine
26	7.30 a.m.	21.87	0218880	3340	1670.0	76.3	102.5	1.63	19	15	34	80	Snow
26	6.30 p.m.	11.00	0220130	1250	625.0	56.8	76.2	1.21	19	15	34	70	Snow
27	9.20 a.m.	14.83	0221780	1650	825.0	55.6	74.5	1.19	29	13	16	68	Windy
28	9.10 a.m.	23.83	0224460	2680	1340.0	56.2	75.3	1.21	19	16	35	68	Fine
Mar.													
1	8.40 a.m.	23.50	0227110	2650	1325	56.3	75.5	1.20	23	6	29	73	Windy
2	4.15 a.m.	19.58	0228920	1810	905	46.2	61.8	1.32	22	17	39	56	Windy
2	6.20 p.m.	14.42	0230920	2000	1000	69.2	92.7	1.48	22	17	39	71	Windy
2	10.45 p.m.	4.42	0231520	600	300	67.8	90.8	1.45	22	17	39	74	Windy
3	8.52 a.m.	10.12	0232380	860	430	42.5	56.9	.91	26	15	41	64	Fine
4	8.22 a.m.	23.50	0235480	3100	1550	65.9	88.3	1.41	18	8	10	68	Fine
5	7.35 a.m.	23.22	0236540	1060	530	22.8	30.6	.49	10	13	23	64	Windy
5	6.25 p.m.	10.83	0238080	1540	770	71.1	95.2	1.52	10	13	23	72	Windy
6	9.00 a.m.	14.58	0240080	2000	1000	68.6	91.9	1.47	24	9	15	78	Snow
7	10.00 a.m.	25.00	0242250	1170	585	23.4	31.4	.50	27	16	43	65	Fine
7	7.45 p.m.	9.75	0243120	870	435	44.6	59.7	.95	27	16	43	71	Fine
8	6.10 p.m.	22.42	0245650	2530	1265	56.4	75.6	1.21	34	2	32	73	Snow
9	7.23 a.m.	13.22	0247190	1540	770	58.2	78.0	1.25	30	24	6	73	Snow
9	9.30 p.m.	14.12	0248240	1050	525	37.2	49.8	.80	30	24	6	69	Snow
10	9.20 p.m.	23.83	0250970	2730	1365	57.2	76.7	1.22	32	3	29	70	Fine
11	9.40 a.m.	12.33	0252260	1290	645	52.3	70.2	1.12	32	9	41	67	Fine
11	7.25 p.m.	9.75	0253270	1010	505	51.8	69.5	1.11	32	9	41	75	Fine
12	8.07 a.m.	12.70	0254650	1380	690	54.3	72.7	1.17	39	6	45	68	Windy
13	7.00 a.m.	22.88	0257220	2570	1285	56.2	75.2	1.20	40	15	25	66	Fine
13	11.20 p.m.	16.33	0259090	1870	935	57.2	76.6	1.22	40	15	25	80	Fine
14	9.07 p.m.	21.78	0260650	1560	780	35.9	48.1	.77	41	10	31	71	Cloudy
15	6.20 p.m.	17.88	0261920	1270	635	35.5	47.6	.76	37	28	9	61	Snow
16	2.30 p.m.	19.17	0263270	1350	675	35.2	47.2	.75	42	28	14	67	Cloudy
17	9.25 p.m.	30.92	0265510	2240	1120	36.2	48.5	.77	40	9	31	70	Snow
18	6.15 p.m.	20.83	0266880	1370	685	32.8	43.9	.70	36	27	9	66	Snow
19	9.20 p.m.	27.08	0269920	3040	1520	56.2	75.2	1.20	15	7	22	72	Fine
20	8.40 p.m.	23.33	0272500	2580	1290	55.3	74.1	1.18	23	8	31	69	Fine
21	9.30 p.m.	24.83	0275300	2800	1400	56.3	75.5	1.21	28	11	17	74	Snow
22	7.45 a.m.	10.25	0276040	740	370	36.1	48.4	.75	31	10	41	58	Fine
23	8.50 p.m.	37.08	0280200	4160	2080	56.2	75.2	1.20	47	1	48	76	Fine
24	9.25 p.m.	24.58	0281900	1700	850	34.7	46.5	.74	39	32	7	73	Snow
25	9.50 p.m.	24.42	0283490	1590	795	32.6	43.7	.70	40	8	32	73	Fine
26	9.12 p.m.	23.37	0285090	1600	800	34.3	46.0	.73	55	32	23	74	Fine
27	9.32 p.m.	24.33	0286390	1300	650	26.7	35.8	.57	45	20	25	72	Cloudy
28	1.00 p.m.	15.47	0287430	640	320	20.7	27.7	.44	32	26	6	67	Rain
28	10.25 p.m.	9.42	0287830	800	400	42.5	56.9	.91	32	26	6	74	Rain
28	9.18 p.m.	22.88	0289720	1890	945	41.3	55.3	.88	34	25	9	71	Snow
30	10.12 p.m.	24.90	0291770	2050	1025	41.2	55.2	.88	31	23	8	71	Fine
31		.	......	...	....	...	....	...	38	8	30	70	Cloudy

Electric Railways

The Toronto Suburban Railway Company Have Just Inaugurated a Splendid Service Over Their New Line from Toronto to Guelph—Operates at 1200 Volts d.c.

The Toronto Suburban Railway Company have just recently placed in operation the extension of their line from Lambton west to Guelph. A service was operated as early as April 14, but it was not until the month of June that a regular schedule was put in force. The extension is operated at 1,500 volts d.c., and during the first few weeks passengers were required to transfer at Lambton to the 600-volt line between Lambton and Keele Street, Toronto. The 1,500-volt equipment, however, is designed for operation on the 600-volt trolley and the new cars now operate through from Keele Street, Toronto, to Guelph, changing voltage at Lambton. The schedule as now arranged includes seven cars each way daily as far west as Georgetown. Four cars daily each way will be driven through to Guelph. On Saturdays and Sundays, one extra each way will be put on between Toronto and Georgetown, making a total of eight each way for that distance. This will provide a thoroughly satisfactory service through a section which up to the present time has been greatly lacking in transportation facilities. It is worthy of note that the area through which this road travels is one of the most fertile agricultural districts in the province.

The map shown in Fig. 1 indicates the complete line of the Toronto Suburban Railway Company as at present operated. During 1914 the Keele Street line was extended as far as Woodbridge and a sub-station was installed at Thistletown. This line operates at 600 volts.

The construction of the roadway and the overhead follows standard practice in general. 93-pound girder rails have been used within the city limits and 60-pound A.S.C.E. outside the city. 1,500 volt sub-stations have been located at Islington, Georgetown and Guelph.

The new 1,500 volt overhead is of catenary construction. Trolley wire is standard copper suspended by steel messenger. The 1,500 volt track is built on private right-of-way throughout. From Lambton to Guelph measures a distance of 46.3 miles.

That this new line is calculated to supply a convenient service throughout the section it traverses is not only shown by the frequency of that service, but by the large number of stops, of which there are 100 in the 46.3 miles, which averages a stop rather more frequently than every half mile. The principal points through which the road passes on its way from Lambton to Guelph are given below. This trip is accomplished in two hours and 25 minutes each way:—Lambton Jct., Islington, Eaton Farm, Summerville, Dixie, Cooksville, Centre Road, Streetsville, Meadowvale, Churchville, Huttonville, Norval, Georgetown, Limehouse, Dolly Varden, Acton, Blue Springs, Eden Mills, Eramosa, Guelph.

Further details of the cars, the car barns and the sub-stations, with illustrations, are given below.

The Cars

The cars are of the centre entrance type and will be ten in number. They are being manufactured for the most part

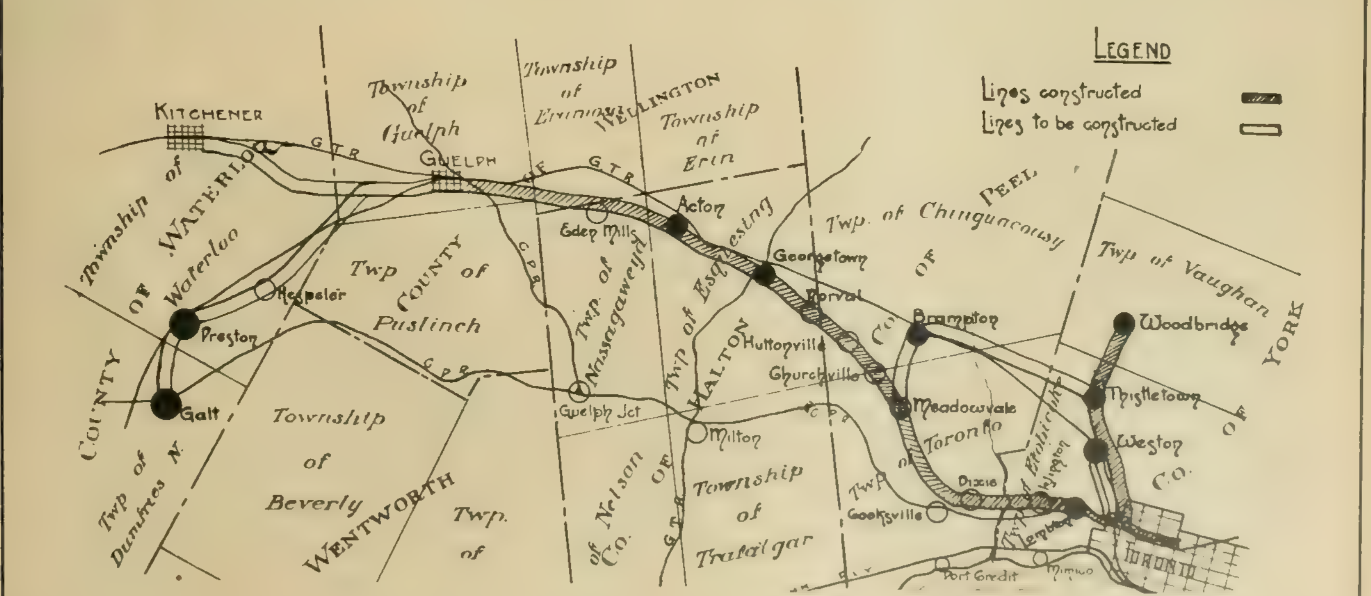


Fig. 1—Map of Toronto Suburban Railway lines, constructed and planned.

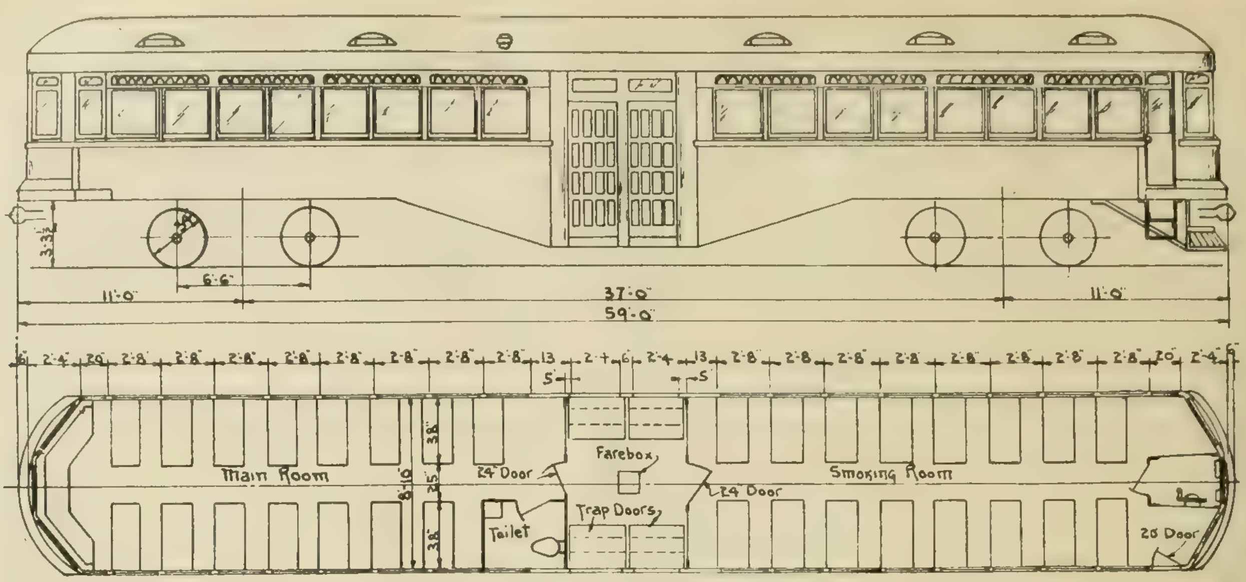


Fig. 2—Elevation and plan centre entrance cars.

by the Preston Car & Coach Company, but on account of this latter company's recent fire, the Toronto Railway Company are lending their assistance in filling the order. The principal dimensions are as follows: Length over buffers, 59 ft.; length over ends, 58 ft.; width over steel sheathing, 8 ft. 10 ins.; width over all, 9 ft.; height from top of rail to under side of side sill at bolsters, 3 ft. 2½ ins.; height from rail to top of first step, 1 ft. 4¼ ins.; height of step risers, 10½ ins.; wheel base of trucks, 6½ ft.; diameter of wheels (rolled steel), 34 ins.; axle journals, 4¼ x 8 ins., M.C.B.

The new cars are shown in plan and section in Fig. 2 and in photograph in Fig. 3. Each car is divided into two sections, the rear compartment for general use, which includes lavatory accommodation, and the forward compartment for smokers. All cars have single end control. There is seating capacity for approximately seventy passengers.

In the design of the steel framing, the continuous centre sills between buffers have been omitted. This conforms to the most modern practice of side girder steel cars, where light weight is desired and single car operation is anticipated. The main centre longitudinal members at each end, extending from buffer beam to bolsters, consist of five-inch rolled steel channels spaced 16 inches apart back to back. Rolled steel angle braces extend diagonally from the intersection of the first cross member and longitudinal member to the end member. The buffer beams are former of 5-inch rolled steel channels with flanges turned outward and projecting 6 inches beyond the end sheathing. The tops of the buffer beams are flanged with sheet steel bevelled upward and forming an angle of 45 degs. The body bolsters are of built-up construction, top and bottom cover plates 15 inches wide and 5/16 to 5/8 in. thick. The side framing is of 5-inch rolled steel channel sills, 2 in. x 1½ in. x ¼ in. rolled steel T. side posts so formed in one piece as to maintain the roof contour and join both side frames. Insulation is provided by a 1-in. wall of cork. The side and end sheathing and letter board plates are of No. 12 B. & S. gauge rolled steel with duplicate splice plates of 8 in. steel.

The roof is turtle back, formed by extension of steel side posts and wooden carlines, spaced 9 in. centres, sheathed with ¾-inch pine and covered with No. 10 cotton duck, laid in white lead and oil.

The centre entrance steps are designed as part of the

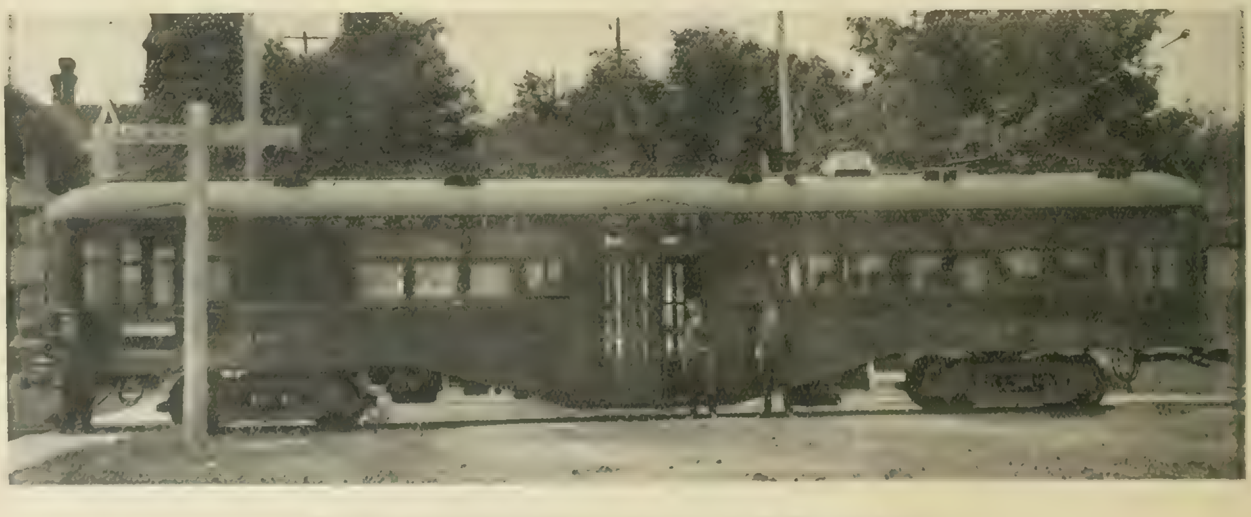


Fig. 3 -Centre entrance passenger car at Main St. crossing, Georgetown.

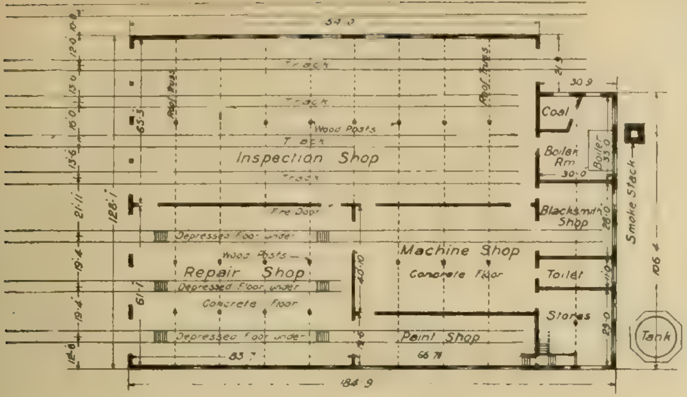


Fig. 4—Floor plan Lambton car barn.

framing and are covered with composition treads 4 ins. wide.

The interior finish of the cars is cherry. The transom and bottom panels of the centre bulkheads are of steel painted cherry on both sides. Head lining throughout is of three-ply poplar veneer. Body sashes are of the raising type. The centre window in the front vestibule is divided into two parts, the upper part of which may be dropped or may be held at different angles. The corner windows at each end are also made to drop. Five automatic ventilators are provided in each compartment and one globe ventilator in the lavatory. All side windows are fitted with pantasotte curtains mounted in metal rollers and are provided with pinch handle fixtures.

The seating consists of 31 walk-over seats in the centre sections with one circular seat in the rear of the main compartment. Each seat is fitted with stationary foot rest and polished bronze hand hold. The smoking compartment has low backed seats upholstered in green pantasote. Annunciator push buttons are furnished for each seat with connection buzzers near the fare box and in the motorman's compartment; a switch is provided on the buzzer circuit wire so that it can be cut in or out by the conductor.

The cars are equipped with four 110 h.p. motors and the control system is so arranged that the cars will operate on either 1,500 volt or 600 volt supply. In going from a 1,500 to a 600 volt section or vice versa, the motorman throws a small switch. Should he omit to throw this switch, selective and protective relays at once come into action and prevent damage to the equipment until the correct control arrangement for whatever voltage section the car is operating on is restored.

The electrical equipment for the cars was supplied by the Canadian General Electric Company.

Car Barns

Car barns have been provided at Georgetown and at Lambton. The Lambton barn is illustrated in Figs. 4, 5 and 6. In general the plan includes an inspection shop, repair shop, machine shop, paint shop, coal and boiler room, blacksmith shop, toilet and store room. The administrative offices are on the second floor over the store room. Toronto pressed brick is used in the construction and the different shops are separated by brick walls with substantial pilasters, the doorways being closed by large sliding doors. Daylight is provided by side windows 8½ ft. wide by 13 ft. in height and by ample roof lights. The roof is of mill construction covered with asbestos tarred and gravelled. The average height of the shops is about 21 feet.

The repair shop has three tracks set in a concrete floor. The whole of the space under the repair shop is excavated for a depth of about 4 ft. and the pit has a concrete floor graded to a sub-pit. The pit is also provided with 2½ ft. gauge tracks on which a hand truck can be operated for mounting hydraulic jacks for raising or lowering car parts.

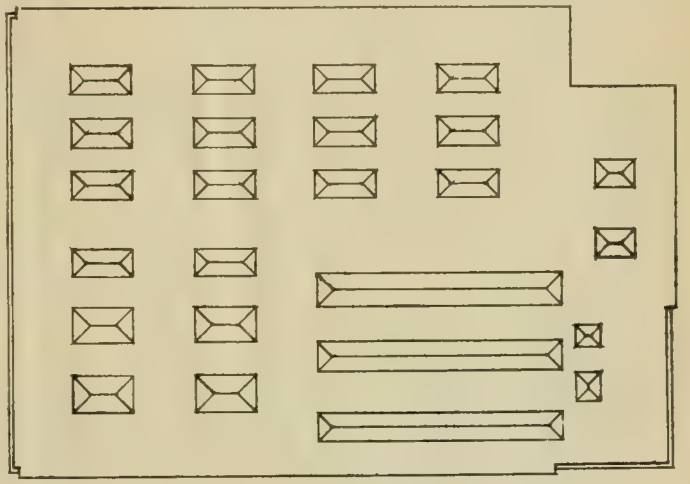


Fig. 5—Roof, showing skylights, Lambton car barn.

The inspection shop contains four tracks, each long enough to accommodate two cars. Pits below the tracks permit the workmen to make repairs.

The machine shop is equipped with the following machinery: 100 ton capacity wheel press; two in one lathe for axle,

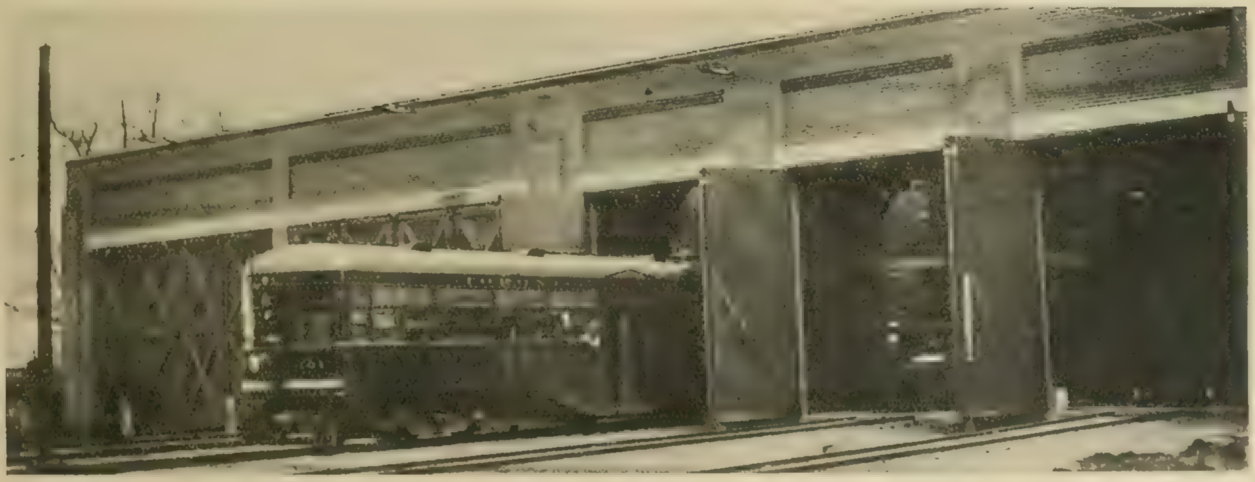


Fig. 6—Car barn at Lambton Junction with centre entrance car.

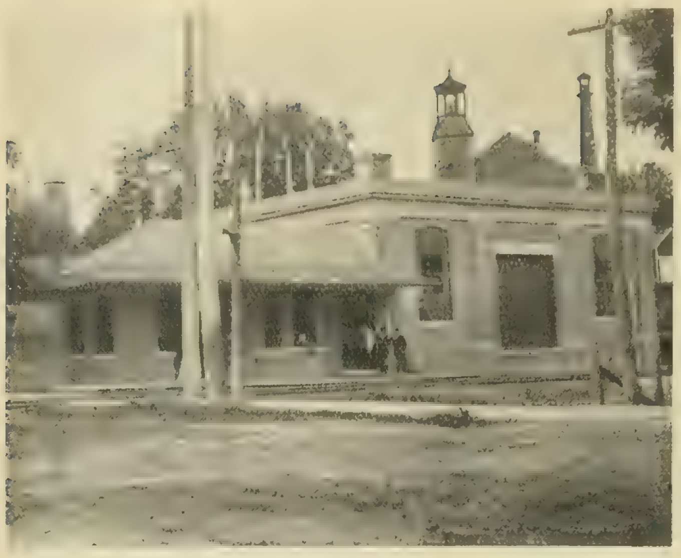


Fig. 7—Georgetown passenger station (left) and sub station (right).

wheel and small work; spindle lathe; combination radial drill; air trip hammer; wheel grinder; shaper; slotting machine; babbitting furnace; soldering iron furnace; forge; air compressor; 2 pit jacks; 2 cranes; travelling crane; benches, vises, machinist's and blacksmith's tools; full set woodworking tools and machines. Two skylights, 8 x 68 ft., run longitudinally in centre of each span and provide excellent lighting to every portion of the shop.

The boiler room contains a 75 h.p. locomotive type boiler. The coal storage is arranged to necessitate a minimum of handling. The chimney has a solid concrete foundation; brick work extends 15 ft. above grade and is then surmounted by a steel stack 36 ins. in diameter and 65 ft. extreme height.

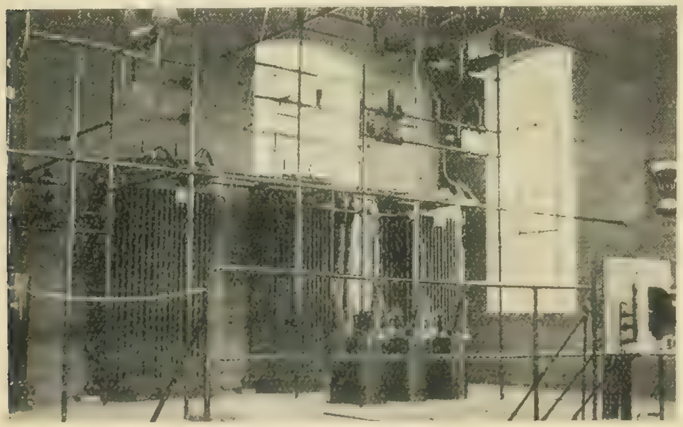


Fig. 8—Interior Georgetown sub-station.

The car barn is heated by low pressure vacuum steam system. The water pressure is obtained from a wooden tank of 10,000 gals. capacity, supported on steel frame work set on a concrete base. Water is pumped into the tank electrically from two wells.

Sub-stations and Overhead

Fifteen hundred volt sub-stations are located at Islington, Georgetown and Guelph. At Islington the building is of galvanized iron construction. The equipment consists of a 500 kw. rotary converter, three 165 kw. transformers, switchboard, etc.

At Georgetown the sub-station is of pressed brick construction, as shown in Fig. 7. This photograph shows the combined passenger station (on the left) and sub-station (on the right). The equipment consists of two 500 kw. rotary converters and six 165 kw. transformers—double that at Islington. The interior of the Georgetown sub-station is shown in Fig. 8.

The Guelph sub-station is also of brick construction, and is designed for the same capacity as is installed in Islington, i.e., one 500 kw. rotary and three 165 kw. transformers.

Transmission supply is at 25,000 volts, so that the sub-stations transform from 25,000 volts a.c. to 1,500 volts d.c.

A typical view of the overhead construction is shown in Fig. 9. The pole line hardware is Boarrow type. The telephone line brackets are placed below the suspension arms. The method of guying the catenary on a curve is shown in this figure. Fig. 10 shows a standard form of shelter with extension roof, both ends.

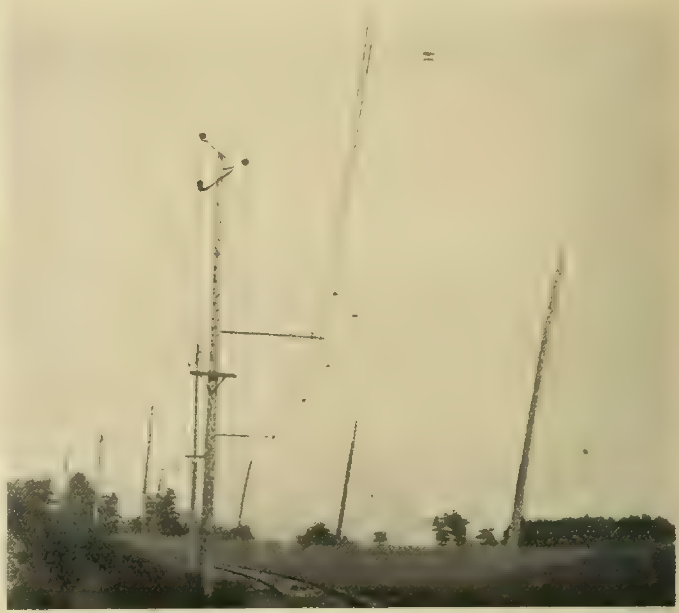


Fig. 9—Overhead construction.

The sub-station equipment was supplied by the Canadian General Electric Company; also the Boarrow pole line hardware as shown in Fig. 9. Current for the operation of the line is purchased from the Toronto Power Company. The supply is taken at Islington, where transformation takes place from the main-line voltage of 60,000 down to 25,000 volts.

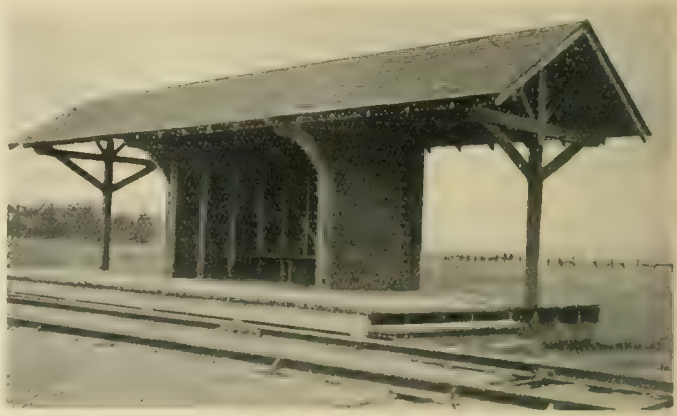


Fig. 10—Standard shelter, extension roof at both ends.

A Safety Car for Kitchener

A new "one-man," or "safety" car, has just been placed in operation on the Kitchener and Northern Electric Railway, on their line to Bridgeport. The trim appearance of the car, with its coat of rich green and gold, has made a very favorable impression in the district. It is of single-truck design, but a special non-rocking truck of extra long wheel-base provides very smooth riding qualities. A new feature is the "pay-as-you-leave" system, which obviates any delay when there are a number of passengers boarding at one point. Opening and closing of doors and raising and lowering of steps is accomplished by a simple lever, conveniently placed at the motorman's left hand. This feature has well demonstrated to travellers on the line the aptness of the term "safety car," in that, with the operation in control of the motorman, there is no possible chance of passengers boarding or alighting while the car is moving. It is anticipated, also, in addition to the safety element, that a much improved service will be rendered, both as to frequency and expediency in handling crowds. The car is equipped with Watson automatic fenders, which are new in Western Ontario.

We reproduce these facts through the kindness of Mr. W. H. Breithaupt, president of the Kitchener and Northern Railway Company.

Public Can Get Service by Paying What it Costs to Produce it

A somewhat unique electric railway franchise, in that it is flexible enough to provide for a sliding scale of fares depending upon the net receipts of the company, is described in a current issue of the Electric Railway Journal. The franchise is that given to the Columbus Railway, Power and Light Company by the city of Columbus, Ohio. The two underlying principles are (1) that the public has a right to demand the particular kind of service it wants, and (2) the public has a right to pay for the service it gets.

Length of Franchise and Control of Service

The original franchise is for twenty-five years. Any time after it takes effect, however, the enabling body, the county commissioners, have the right to renew it for such period, not less than fifteen years or less than the then expired term, as they may be by law authorized. The commissioners through an appointed representative, the street railway commissioner, have the right to control the service, including the fixing and altering of schedules, the changing of service and the establishing of stops. They must not require service to such an extent that enough money will not be produced to make good any loss in the working capital later described.

The commissioners have general control of service, however, only when under the original franchise or any renewal accepted by the company the grant has more than fifteen years to run. When the grant or any renewal has less than fifteen years to run, the company assumes control of the service and may charge during the unexpired term any fare not in excess of the maximum now provided. If the commissioners, however, offer a renewal extending the life more than fifteen years and this contains no substantial changes or additions to the burden of the company, the commissioners retain control if the renewal is refused by the company. Yet it is especially provided that the right to accept such offer of renewal at all times remains with the company.

Earnings Allowed and Fares to be Charged

The company is allowed to earn 6 per cent. upon its present investment and 8 per cent. upon future capital investment. Its present investment was fixed by arbitration at $350,000. For the first ten years the company waives all earnings upon $75,000 of this amount. It adds, however, a cash working capital of $25,000, making a total investment of $300,000 at the beginning of franchise operation.

The franchise provides for a sliding scale of fares. The following schedule has been adopted for ticket fares: (a) Four tickets for 10 cents; (b) five tickets for 15 cents; (c) ten tickets for 35 cents; (d) five tickets for 20 cents; (e) ten tickets for 45 cents; (f) five tickets for 25 cents; (g) ten tickets for 55 cents, and (h) five tickets for 30 cents. The maximum cash fare to be charged is 6 cents for any zone, there being three zones now established for a distance of 10.364 miles. As long as the zone rate of fare upon a ticket basis is 4.5 cents or less, the cash fare is to be 5 cents a zone. When the ticket fare is more than 4.5 cents, the cash fare will be 6 cents a zone. Nothing in the grant precludes the use of commuters' rates with the approval of the county commissioners, but such rates can be established only by the company.

The fare used at the first is that provided in (d), five tickets for 20 cents, or a cash fare of 5 cents. Changes from this or any other rate are to be made upon the following basis: To the working capital, beginning at $25,000, are to be added each month all passenger and freight receipts. From it each month is to be deducted the cost of operation, one twelfth of the estimated annual taxes and one-twelfth of the annual return upon the investment for that month. When the balance equals or exceeds $35,000, the next lower rate of fare must be put into effect; and when it equals or is less than $15,000, the next higher rate of fare. Any lowering of fares must take place at the order of the county commissioners after any monthly report from the company discloses the condition of the fund to warrant it. Any raising of the fare may be made by the company after its report is filed.

Improvements, Purchase and Arbitration

Either the company or the county commissioners may propose extensions, betterments or permanent improvements. When proposed by the commissioners, such improvements must be made if the company can procure the necessary money, unless they are held to impair the present or future ability to earn the allowed return. In such a case the company's claims must be arbitrated. Improvements proposed by the company must be approved by the commissioners before the expense is incurred. All approved improvements are, of course, added to the rate basis.

It is agreed that the company will at any time, upon six months' notice in writing by the commissioners, sell to the public its property at 110 per cent. of the investment at the date of purchase. This will consist of $350,000, plus the working capital of $25,000 and all capital investments made after the date of the present franchise.

Whenever differences arise between the commissioners and the company they are to be submitted to arbitration, the decision of the board to be binding upon all parties.

The Chicago, Milwaukee and St. Paul Railway Company have undertaken the further electrification of their lines as follows: Othello to Cle Elum, 99 miles; Cle Elum to Seattle, 90 miles; Black River Junction to Tacoma, 28 miles—a total of 217 miles. Added to the 438 miles already electrified this will give the railway a total of 655 miles electrically operated. About half of the new electrification work is over heavy mountain grades and through tunnels. Distribution throughout will be 3,000 volts, direct current.

Personals

Mr. Geo. Scott has been appointed superintendent of the Moncton Tramways, Electricity and Gas Company, replacing Mr. A. B. Coryell, who has resigned.

Mr. W. J. Lynch has been appointed general manager of the Quebec Railway, Light, Heat and Power Company. Mr. Lynch was formerly treasurer and controller of the company.

The Dealer and Contractor

Don't Stay in the Dark regarding the Status of your Business—Perhaps your Stock is Badly Chosen or your Profits are too Low

There is more in business than simply getting contracts or selling goods. The work must be profitable. Too many merchants guess at their figures, others make mistakes in their calculations, and quite a number "kid" themselves into believing they are making a profit when they are not, simply because their accounting methods are wrong. There is little satisfaction in carrying on a business unless it pays, however good a service one may be giving, for sooner or later you are down and out. So, the following hints outlined by Mr. H. P. Hildreth, in the National Electrical Contractor, are worth our careful attention. He says —(1) Don't carry too large a stock; (2) learn how to mark your profit and (3) it isn't always the man with the biggest capital that makes the most money.

Too Much Stock

About six months ago a small dealer in a small town in New York State saw the signs impending disaster. He was hard pressed and financially crippled. His business had been falling off for some time past. He could not meet his obligations, and his bank had extended him his last loan. Something must be done before he got in where he could not swim out.

So he looked about his store and picked out the four lines on which the turn-over was quickest and the profits biggest. He spent his last dollars on these lines. He bought heavily. He specialized on the four quick-selling, big-money items. He sold these goods and re-ordered. He re-ordered the third time. He met all his outstanding notes and rebuilt his business. To-day he is conducting a specialty store rather than a general shop. And he is making more money from these four lines than he ever did before from forty lines.

The point is this: This merchant had fallen into the well beaten rut of poor buying. He had purchased merchandise which his clientele did not need. It was this merchandise on his shelves that hung like a dead weight around his neck, and sucked the nourishment from the entire business. Part of his working capital was tied up in goods that never left his store.

But when he saw the light—when he found the reason for his threatened trip to the bankruptcy court—he rid his store of this dead stock and concentrated his efforts on profitable money-making lines.

How to Mark Profit

A merchant who has just made a land slide trip through the bankruptcy court attributes his failure to his inability to mark for the correct percentage of profit. For years he had the erroneous idea that percentage of profit was based on the capital invested rather than on the gross business.

His investment was $20,000. His gross business was $100,000. He figured that a 5 per cent. profit was sufficient interest on the money, but he took this 5 per cent. on the investment and not on the gross business. If he was doing $100,000 on $20,000 he was turning his capital five times during the year, which would mean, according to his figuring, that he should clear a 25 per cent. profit on the gross business.

Now, 5 per cent. on $20,000 is $1,000. This was really his profit on a $100,000 business or 1 per cent. Is it any wonder the business did not live! Thousands of businesses go the same way—because the proprietor fails to mark for profit.

There can be one and only one rule for marking goods, and this rule can be reduced to the following formula:

Selling price equals cost plus expense plus profit;

Selling price always equals 100 per cent. We will assume that a 5 per cent. is desired and that the percentage of expense, as figured the previous year is 15 per cent. Then the cost of goods would be 80 per cent. Now then, figuring on a basis of $100,000 gross business, we have:

$100,000 equals 80 per cent. plus 15 per cent. plus 5 per cent. or $100,000 equals $80,000 plus $15,000 plus $5,000.

From this we see that a 5 per cent. profit on a gross business of $100,000 would be $5,000, and not $1,000, as my friend had figured.

A safe rule to follow is to figure everything from the selling price and not from the cost.

Small Capital Often Sufficient

Some merchants make a success on small capital while they envy the fellow who has a big working investment. If I were starting in business to-day I would rather start on a small capital and gradually put more into it, as the business grew. Small capital is better for the beginner because it demands more careful buying and quicker turn-overs—and these are the two things that can make or break a business. The man who begins on a small investment should buy quick sellers, sell close—or if he can find quick sellers that bring long profit, so much the better—and then re-invest in more stock.

The great trouble with many new merchants is that they try to stock complete and heavy before the doors are open to the public. This cannot be done on small capital. Stock staple lines, and gradually expand to novelties or other less called for merchandise.

I.E.S. Hold Soldier Members in Good Standing

At the last meeting of the Council of the Illuminating Engineering Society it was decided that any member or associate member of the society in good standing when entering the military or naval service of the United States, or any of her allies, may, upon request before October 1, 1917, or if called out after that date, have his name retained upon the membership roll of the society, without payment of dues, during the year ending September 30, 1918. In lieu of the regular annual convention, which has been abandoned, the society will hold a "correspondence convention," during the course of which the papers prepared for this annual convention will be circulated among the interested members, in advance of publication in the transactions, and written discussions on these papers may be submitted for publication. It is believed that in this way the value of the papers and discussions will not be lessened due to the cancellation of the annual convention. Titles and authors of papers will be published in advance in the transactions and other technical publications. Any who are interested in such papers may receive a copy and submit discussions upon application to the general offices of the society, 29 West Thirty-Ninth Street, New York, N.Y.

Canadians "Expropriate" Power Plant at Vimy Ridge.

We are indebted to Mr. G. D. Earle, of the Earle Electric Company, 72 Nelson Street, Toronto, for the illustration reproduced herewith. It is the diagram of a German electric distributing station which our gallant soldiers took possession of when they succeeded in wresting from the enemy that important position. The original diagram, of which this is a reproduction, was a pencil sketch dated Feb. 8, 1916, and found, pasted to the wall of the sub-station, by Mr. R. D. Earle, who was present with his battalion, the 116th. Mr. Earle secured the relic and mailed it to his brother in Toronto, on whose office wall it now occupies a prominent position.

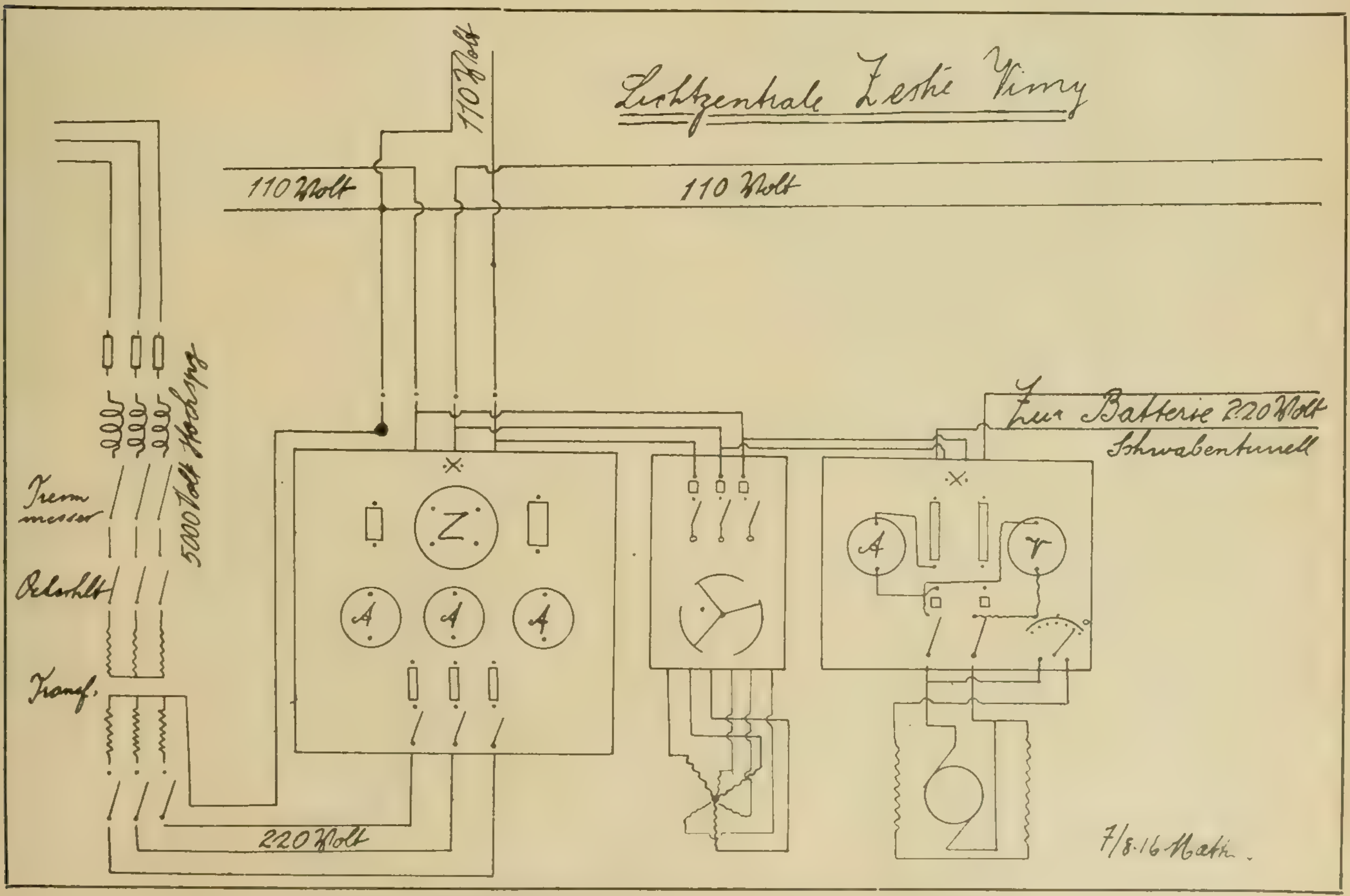
The contractors and dealers who knew "Rufus" in the palmy days of the Electrical Dealers and Contractors' Association, as the irrepressible and energetic secretary of that body, will be delighted to know that he has been doing his share of "trench" work in France for several months, and that so far the "Hun" has failed to mark him. May his luck continue and his usefulness increase.

The diagram evidently represents nothing out of the ordinary—the usual 4-wire, 110-220 volt distribution. The various instructions read, on the left side—knife switches, oil switches, transformers, 5,000 volt high tension; at the top—central lighting plant, Vimy Fort; on the right—to battery, Schwabian tunnel. The chart is signed, "Matheis," but the surname is torn off.

How to Operate a Range

The Hughes Electric Heating Company are distributing a useful little booklet on the care and operation of the electric range, which, incidentally, applies to any electric range. As the preface states, this booklet is published for the careful, conscientious housewife and should be followed implicitly, as it is the result of the experience of many specialists who have studied the question of electric cooking most carefully. At the outset the housewife is admonished not to overheat the oven. The principle upon which an electric oven operates is a lower heat over a longer period, which produces better results than higher temperatures over a short period. Therefore, it is not necessary to drive the thermometer beyond the highest range. The oven should also be kept sweet and clean and free from rust by leaving the door open for a short time after each cooking and by going over the interior once or twice a month with a cloth oiled with lard or olive oil.

Users are warned that it is not necessary to clean the elements when liquids boil over because the substance oxidizes in a short time and disappears. For the same reason it is not necessary to clean stains or to scour or scrub the heating element in any way as the intense heat burns off the discoloration. Of course, it is good policy to use reasonable



Central Lighting Plant Captured by the Canadians at Vimy Ridge.

care not to discolor the elements or to allow anything to boil over on them.

Another point that is emphasized is that it is only necessary to use a little water in cooking meats or vegetables. It is urged that just enough water should be used to cover the bottom of the vessel and to close them in tight with covers so as to condense the steam, as this steam will cook the food better than a potful of boiling water. It is pointed out that water never becomes hotter than its boiling point and that forcing the water to boil furiously does not increase the temperature or diminish at all the time required to cook the food.

Some useful hints are also given regarding the temperature of the oven when various articles are to be cooked. For example, a roast should never be placed in a cold oven and the current should be turned off at least half an hour before the meat is required for the meal, so that the residual heat in the oven can be utilized for completing the cooking. It is also pointed out that better results are obtained at lower temperatures than if the full heat is maintained.

Ruled space is left in the booklet so that each housewife may keep her own cooking records. There is a column for food; another for temperature when the food is placed in the oven; another for the length of time the element is on high, low or medium, and space for remarks. If the average user of an electric range could be brought to look upon the operation of cooking as worthy of keeping such records as are possible by these forms there is little doubt that there would be a considerable reduction in the monthly electric light bills and probably also an appreciable improvement in the quality of the cooked article.

A Successful House Wiring Campaign

A very productive house-wiring campaign has recently been held in Kitchener, by the Twin City Electrical Association. The object of the campaign was to bring in considerable new business before the contractors were forced to raise their prices to any extent, which was inevitable, owing to the increased prices of material.

All of the electrical contractors in the twin cities, Kitchener and Waterloo, participated in the campaign and both the Kitchener and Waterloo light commissions co-operated also.

The actual results in Kitchener were 57 new consumers, obtained, while Waterloo gained from 12 to 15.

Newspaper advertising was used daily during the campaign, half and quarter-pages being used. The copy all consisted of special appeals to the people, giving substantial reasons why their houses should be wired for electric light, and at the same time showing what an extraordinary opportunity it was to have them wired during the three weeks' campaign, and the price saving to be effected by doing this. Fixtures and appliances were also priced specially for the campaign.

The Twin City Electrical Association set a very fair price for work done during this period—$2 per outlet.

The campaign was given added impetus by the large amount of advertising space used and by another novel feature. Certain members of the Electrical Association were given territory in each ward of Kitchener and Waterloo. Tags similar to order billing tags (except that they were 4 by 6 inches in size and had holes punched in the ends) were used. These tags were tied to the door knobs of each unwired house in Kitchener and Waterloo, and this was followed up by personal calls and canvasses.

Taking into account the amount of wiring done, the number of fixtures and appliances sold, and the general stimulus of trade in both cities, the members participating in this campaign were very gratified with the ultimate results.

The Kitchener Light Commission agreed to pay $4 toward the advertising of the campaign for each new customer obtained, with a maximum of 30 customers, which would amount to a total of $120. The results show that instead of paying $4 for each customer it cost the Kitchener commission only $2.11 per customer.—Hydro "Bulletin."

Ready for Christmas Trade

The Commercial Section of the National Electric Light Association has issued sample copies of its 1917 Christmas booklet. Mr. F. D. Pembleton, chairman publication committee, states that many companies in different parts of the country have co-operated in preparation of the booklet. This year, with constantly increasing costs of paper, printing, etc., Mr. Pembleton says that central stations will find the effective and practical booklet especially economical. Shipments will be made well in advance of the Christmas season, insuring deliveries in ample time for early distribution to customers. The price, f.o.b. New York, ranges from $3.60 for 100 copies to $16.50 per 1,000 in quantities of 50,000 and over.

A. C. Oil Switch for Reversing Service

To meet the increasing demand for an oil switch for use with small alternating current motors which can be started by connecting them directly to the supply current, the Crocker-Wheeler Company, Ampere, N.J., has developed a moderate priced oil switch which embodies many important features seldom found in switches of this type. The moving contacts are mounted on a fiber-insulated rod. These moving contacts make contact with the center row of stationary contacts and one of the outside rows of contacts when the switch is in the "forward" position and with the center row of stationary contacts and with the other outside row of contacts when the switch is in the "reverse" position. This novel switch movement gives a very large break on two points per pole.

The moving contacts are free to turn on their axis so that a new contact surface is continually presented to the fixed contacts, thereby prolonging the life of the switch. The contacts are easily removable and are of copper of liberal size. The tank holding the oil in which the contacts are immersed is bolted to the upper part of the switch. Oil cannot splash into the wiring chamber under ordinary conditions of use. A removable cover permits easy access to the terminal board which is provided with heavy binding posts. No special ells or fittings are required in the case of conduit

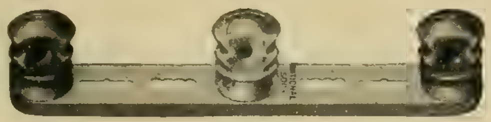
A New Lantern Shape in "Moonstone" Jefferson Glass Co., Toronto

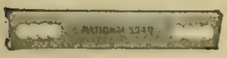
wiring. The switches can be furnished with or without latches for holding the contacts securely in the desired position. No latches are needed where the switch handle is operated by an arm or rod for controlling from a nearby point. Such an arm or rod has sufficient friction with its supports to serve for holding the switch contacts in the proper position. The operating handle, shaft, star-wheel and bell crank arm are one integral casting. Indications of "off," "forward" and "reverse" positions of the operating handle are cast in the case of the switch. Heavy lugs are provided for mounting these switches on a wall, machine or post. The normal rated capacity of these switches are, 4-pole, 20 amperes per pole, suitable for use with motors up to 5 h.p., 220, 440 or 550 volts, 2 or 3 phase and, 3-pole, 40 amperes per pole, suitable for use with motors up to 10 h.p., 220, 440 or 550 volts, 3-phase, and with motors up to 10 h.p., 220 and 440 volts, 2-phase, 3-wire. These switches are regularly carried in stock for reversing service. They can be arranged for single-throw operation, either right-hand or left-hand assembly.

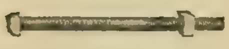
New National Metal Molding Lines

The National Metal Molding Company, Pittsburgh, have added to their line of wall brackets a single point screw type bracket, No. 5011, as illustrated. The insulator on this bracket is of the same design as on other "National" brackets; the necessity of using "tie-wires" has been entirely eliminated, as it is intended that the wires be threaded through the "iron-bound" insulators, very similar in construction to strain insulators. The design of the insulators, however, is such that "tie-wires" may be used when desired. The bracket shown, the manufacturers claim, is especially adaptable for supporting wires to wood surfaces. A 2-inch No. 20 wood screw is firmly attached to the sherardized base, in such a manner as to entirely eliminate the possibility of its turning or pulling loose. The bracket is not only exceedingly rugged in construction, but especially neat in appearance. This company has also made some slight changes in the design of their No. 5003 three point bracket which still further enhance the universal application of "National" brackets. Through the provision of slots, as illustrated, and similar slots in straps No. 5040, in conjunction with bolts No. 5051, this bracket may be used as either a two or three point break arm. The slots allow for the varying sizes of cross-arm, or for the application of the brackets in either a vertical or horizontal position, as illustrated in Figs. 1 and 2.

No. 5011


No. 5003


No 5040


No. 5051

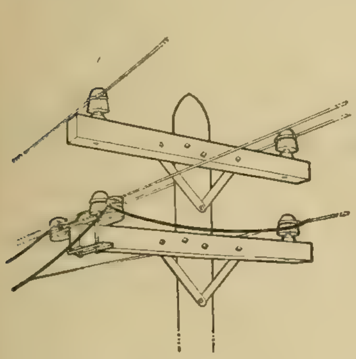


Figure 1.

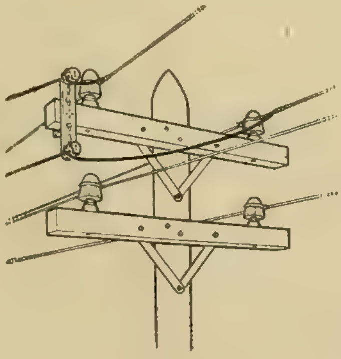
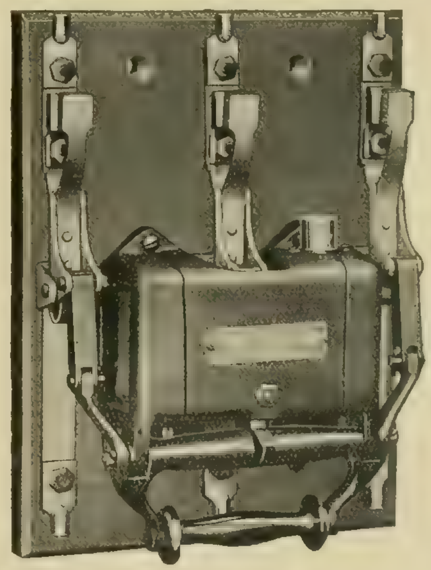


Figure 2.

With a stock of one, two and three point brackets, corner chairs, break arm straps and bolts, it is claimed that practically any service connection can be made, that the necessity of carrying a large variety of "special" brackets, for which there is but occasional demand, has been entirely done away with; that the investment charge is thereby greatly reduced, and further, that the elimination of the necessity of tie-wires, especially at the present high prices of copper, effects a marked reduction in both labor and material costs. The complete line of "National" brackets is fully described in Bulletin 601, just off the press.

Distant Control of Incandescent Lights

The switch illustrated herewith has marked advantages for use in moving picture and other theatres, halls, stores, libraries and like places where centralized control of illumination, ventilating fans or electrical devices for light work, is desirable. Control may be centered in one special push-button switch or in different locations by the use of a number of push-puttons, wired in multiple. The control buttons operate at finger pressure and send current through the two solenoid coils on the switch only at the moment of operation. One coil opens the switch and the other closes it. The switch is a self contained unit with two sets of contacts. The main set has the special C.G.E. laminated copper brushes that make an "end on" contact with the switch blade with no tendency to force the laminations apart. The contact surfaces are kept bright and a good contact assured by the wiping effect given the contacts every time the switch is closed. The secondary carbon contacts take the arc on breaking the circuit. The brush laminations are under considerable pressure when the switch is closed and assist in making a quick, clean break when it opens. There is also a handle on the switch for manual operation. Simple, durable and reliable, there is nothing to get out of order. The switch is made single throw, single, double, or triple pole. This switch is manufactured by the Canadian General Electric Company and gives complete and instantaneous central control of lights or other electrical devices operated on direct or alternating circuits of 110/125 or 200/250 volts.



Current News and Notes

Belleville, Ont.

The Canada Cement Company's Lehigh mill, Belleville, Ont., which has been closed down since April owing to scarcity of labor, is about to begin operations again. This mill uses over 3,000 h.p. of Hydro power.

Brockville, Ont.

The town council of Brockville, Ont., has accepted an offer of the Hydro Electric Power Commission of Ontario to supply power from Cedars Rapids, the commission to build the transmission plant and deliver 10,000 h.p. to the town at $35.95.

Camp Borden, Ont.

The construction of a distribution system for the Royal Flying Corps, Camp Borden, Ont., has been completed and the machine shops, flight sheds, barracks and other buildings in connection with the aviation camp are now being supplied with light and power through the Camp Borden substation.

Coldwater, Ont.

The municipality of Coldwater, Ont., is proposing to extend the local distribution system to take care of a stone quarry located about one mile outside of the village limits. This load has been secured due to the present high cost of coal and will increase the town consumption by about 40 h.p.

Collingwood, Ont.

The Collingwood water and light commission has completed the construction of a new feeder from the sub-station to the steel plant operated by William Kennedy & Sons. This feeder will be utilized for the purpose of operating an electric steel furnace. The possibility of a permanent industry as far as the manufacture of electric steel is concerned, is very promising. The company is already operating two open hearth steel furnaces and contemplates the installation of an additional electric steel furnace should the present installation prove satisfactory and the market continue favorable.

Cookstown, Ont.

A by-law will be submitted in Cookstown, Ont., on August 20, to provide $9,500 for the transmission and supply of electric power.

Healey Falls, Ont.

The tail race section at Healey Falls, Ont., is being enlarged to provide capacity for the new unit which is being installed.

Montreal, Que.

The Siemens Company of Canada Limited, Montreal, have contracted to supply a generator set to Yorkton, Sask., a duplicate of one now installed. The generator will be 400 kv.a., 60 cycle, 3 phase, 200 r.p.m., 220 volt, alternating current, to be direct connected to a Diesel engine. The equipment also includes a direct connected exciter.

The Southern Canada Power Company, which is gradually extending its operations on the south shore of the St. Lawrence, is engaged in linking up cities and towns which have recently come within its enlarged territory. A 44,000 volt line is being constructed from Sherbrooke to Granby by way of Foster, which will take care of the lighting and power requirements of the towns named. The line will, in fact, link up with Sherbrooke the distributing systems at Waterloo, Foster, Knowlton, Sweetsburg and Cowansville. Additional sub-stations will have to be constructed, including one at Granby, where some property on the main street has been acquired for the erection of a store and office building, with the sub-station in the rear. Another transmission line is being built from Bromptonville to Sherbrooke, the company having taken over the municipal plant at the former place.

Ottawa, Ont.

Mr. J. T. Johnson, chief hydraulic engineer in charge of all field power and storage investigations carried on in the west by the Dominion Water Power Branch, has been elected a member of the Canadian Society of Civil Engineers.

Smith's Falls, Ont.

A by-law will be submitted in Smith's Falls, Ont., on August 22, authorizing the purchase of the electric plants of the Citizens' Electric Company and the Smith's Falls Electric Power Company for $135,000.

Stouffville, Ont.

The electric light plant of Stouffville, Ont., which was formerly operated under steam, has been changed over to a gas engine. It is anticipated a saving of $1,000 a year will be effected.

Swift Current, Sask.

The town council of Swift Current, Sask., on July 17 passed money by-laws for the issuing of debentures for $30,000 and $25,000 for necessary improvements to the electric light and power plant.

Toronto, Ont.

Contracts have been let by the Hydro-electric Power Commission of Ontario covering the installation of a 4,000 h.p. generator and turbine at the Eugenia development. The installation of this unit will double the present capacity of the plant.

The Toronto Electric Light Company have increased their rates approximately 10 per cent. The advance is explained by the increased cost of coal, material and labor.

Mr. A. T. C. McMaster has been elected a member of the Canadian Society of Civil Engineers. He is designing engineer for Kerry & Chace, Limited, Toronto, on the Calabogie power plant.

Tottenham, Ont.

A by-law was voted upon in Tottenham, Ont., on August 13, to provide $9,000 for repairing and improving the electric plant.

Trenton, Ont.

The construction of a transmission line from Healey Falls to Trenton has been commenced. This line will operate at 44,000 volts and will be of pin-type construction, the conductor being of No. 2/0 copper cable.

Victoria, B.C.

Mr. E. N. Horsey, of Victoria, resident engineer for the B. C. Electric Railway Company in charge of construction and maintenance of way for Victoria and suburban lines, and construction and maintenance engineer of various properties of the company and subsidiary companies on Vancouver Island, has been elected an associate member of the Canadian Society of Civil Engineers.

Electrical News
Generation, Transmission and Application of Electricity

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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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Vol. 26 Toronto, September 1, 1917 No. 17

Can We Increase Canadian Crops by Electric Stimulation?

Each day brings forth a new application for electricity. The latest, though it is at the same time one of the most promising, is that of increasing the quantity of production on our farms and gardens. The idea is a new one to many Canadians, though experiments have been carried on at various points on the continent for a number of years. Information of a convincing nature has been difficult to obtain, however, owing to the purely experimental stages of the work. Less interest, too, has been felt in this application, in Canada, no doubt owing to our almost unlimited uncultivated areas which still offer thousands of acres of virgin soil unexcelled in its natural productiveness.

The time is coming, however, when we in Canada must consider the adoption of agricultural methods more in keeping with practices on the European continent. The tendency is already towards more intensive cultivation—less area, more product. We are driven in this direction primarily by the shortage of labor, but also by the secondary fact that profits are equally as large, if not larger, and that the work is more congenial, possessing a pleasurable smack of the "scientific" control of those unfavorable conditions which at present make the life of the average farmer a mere slavery and have been the means of depleting the farms of our young men and crowding the cities and towns unduly.

Intensive farming of small areas has many other apparent attractions, not the least of which is the improved social conditions. Ten families on an area now occupied by only one will remove the terrible loneliness of the farm and will make possible, if the homes are properly grouped, the installation of modern conveniences such as water, sewage, light and power at a much lower cost than is possible under present conditions. In a word, intensive farming can, we believe, be made so attractive that the drift to the cities of our young men and women would soon be stopped.

Of course, one of the biggest elements in turning this dream into a reality is cheap and widely distributed electricity. Little by little the tiny wires are extending along the main roads, creeping down the sideroads and giving promise of forming, in the near future, a network of "blessing" which shall cover each county and township and bring every living thing under its influence. "Light and Power" is the magic load they carry and to its "power" applications, as already noted, there seems as yet no limit. Practically every operation in the home and about the farm buildings can be done, better, by electric "power" and now to this is added the almost certainty of increasing production.

In this direction the possibilities are quite unlimited. The first thing one thinks of is, naturally, grain and vegetables. The preliminary experiments carried on in the last five years, and about which we have published numerous items in the recent past, show increases in this direction up to at least 50 per cent. with comparatively small energy costs. Some months ago we had reports of very great increases in the growth of wool on sheep pastured in the presence of electrical discharges. If plant life is stimulated, why not animal life?

In this issue we have another article taken from a current issue of "The Engineer," which sums up in an intelligent and interesting way the history of electro-culture from its inception to the present day. Apparently these experiments have reached a stage when they are almost ready for the practical farmer. This being so, it is high time that our own agricultural departments should be conducting their own tests. After the war hundreds of thousands of laborers will be available for intensive farming if it is at the same time profitable and pleasurable. Experiments should be started now so that accurate data may not be entirely lacking when it is most needed.

Engineering Council Organizing Its Forces

Subsequent to the organization meeting held on June 27, 1917, the Engineering Council of the United States has held two other meetings, one on July 13 and one on July 26. It has considered many matters of interest to engineers in general, and has appointed standing committees on Public Affairs, on Rules, and on Finance. Many matters coming before the Council, both from the several founder societies and from the Council's predecessor, the Joint Conference Committee of National Engineering Societies, have been considered and referred to appropriate standing committees for investigation and report. The Council has also created a War Inventions Committee, to co-operate with the Naval Advisory Board and other departments at Washington if desired, in the promulgation to engineers of war problems now before the government, and for which there are opportunities for solution by means of inventions. It has also created a committee which is to collect and compile such information regarding engineers of the country as will enable the committee to co-operate with the different departments of the Federal Government on request, and to assist in supplying the Government's need for engineering services.

While the Council comprises only members from the four founder societies (i.e., the American Society of Civil Engineers, the American Institute of Mining Engineers, the

American Society of Mechanical Engineers, and the American Institute of Electrical Engineers) and, of course, can claim no right to speak for members of other societies nor for engineers at large, the Council members feel that the body will not have accomplished the results for which it was created unless it early establishes means of cordial co-operation with engineers, organized or otherwise. Every effort toward this end is contemplated.

Report on Electrical Development Company

The commissioners who will investigate and report on the Electrical Development Company are: Chief Justice Sir William R. Meredith, Mr. Justice R. F. Sutherland, and Mr. Justice T. Kelly. The scope of their report will include:

(a) The quantity of water in cubic feet per second which the said The Electrical Development Company of Ontario, Limited, is entitled to divert or use.

(b) The amount of power in horse-power which such company is entitled to generate or develop.

(c) The extent, if any, by which the capacity of the works installed or equipped by such company exceeds the amount of power in horse-power which such company is entitled to develop or generate.

(d) The price and terms and conditions upon which, having regard to all circumstances and to the rights of each company as ascertained by the commissioners, the power, to the extent of such excess, should be delivered to the Hydro-electric Power Commission of Ontario as provided in Section 13 of the water powers regulation act, 1916.

(e) Such other matters connected with or arising out of the subject matter of the reference as the commissioners may deem expedient.

Acceleration—An Electric Vehicle Feature

The rapid acceleration necessary in congested traffic is admirably accomplished by the electric vehicle. This is an important point to consider in the purchase of an automobile, especially for urban use, for acceleration is an extremely big factor in rapidly negotiating heavy traffic.

The uniform high rate of acceleration possessed by the electric vehicle is well illustrated by the successful electric taxicabs in Detroit, and there is probably no other service in which rapid acceleration is quite so necessary. In short, the greatest ease of travel is characteristic of these "electrics," as they are capable of speedy manoeuvring through city traffic, with the elimination of all jerks and jolts and the consequent strain on the mechanism, accentuated in the more complicated automobiles, thus assuring a longer life than is common to the gasoline taxicab. It is also interesting to note that although electric vehicles accelerate rapidly, this forward movement is accomplished in such an uniform manner that the life of pneumatic tires is two or three times greater on these easy rolling "electrics" than on gasoline cars operating over the same routes.

To give some practical idea of the high average speed which an electric vehicle maintains in congested traffic, which in a measure is due to its ability to rapidly accelerate after traffic delays, reference might be made to some tests that have been made when a stock electric town car and a gasoline automobile capable of very high speed started at the same time from Broadway and 42nd Street in New York City and the "electric" arrived first at the Battery, a distance of four miles.

Hydro transmission lines are now within a mile of Brigden, Ont., and alterations are being made in the local wiring system to accommodate the new system, which will be ready shortly.

Electrically-Driven Panorama Used by C.P.R. for Advertising Purposes in the West

The Canadian Pacific Railway Company are showing, throughout the west, an electrically-driven panorama of mountain scenery. The panorama is an oil-painting of Rocky Mountain scenery, 4 feet high and 50 feet long, the two ends of the canvas being sewed together so as to form a continuous picture. The canvas is mounted in a doubled-up position behind a gilded frame 10 feet long by 4 feet high, as shown, Fig. 1, so that only 10 feet of the panorama is visible at any time.

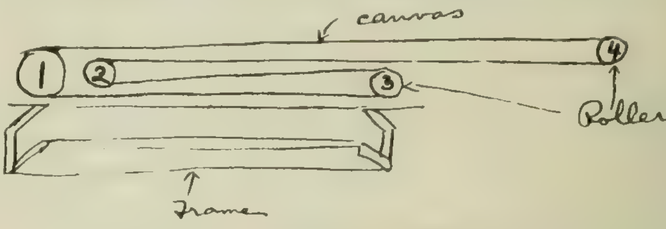


Fig. 1—The canvas is mounted in doubled-up position.

The canvas hangs loose from a continuous link chain having extension lugs and cross pins which slide along four straight sections of suspended track. The panorama passes quite loosely over four wooden rollers having sprocket wheels at the top in alignment with the chain, so that when the chain moves along and leaves the ends of the tracks, it engages in the sprocket wheels, makes a half revolution over them and moves on to the succeeding section of track. The whole chain is driven by sprocket wheel No. 3 at a speed of 20 feet per minute, so that the panorama travels past the frame (from left to right) giving a complete change of picture every 30 seconds, and a whole revolution of the canvas every 2½ minutes, there being 5 complete changes of picture to one revolution of canvas.

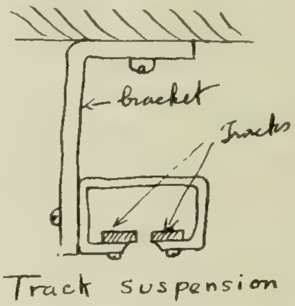


Fig. 2—Showing track suspension.

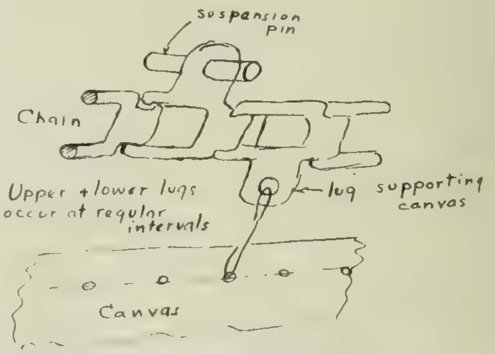


Fig 3—Chain has extension lugs and cross pins.

The driving motor is a ¼ h.p., 110 volt, 60 cycle, 1800 r.p.m. single phase Wagner repulsion motor, and it drives the sprocket wheel No. 3 by means of pulleys located in the base of the apparatus. A very low speed of the sprocket wheel was necessary to give the slow motion of the panorama,

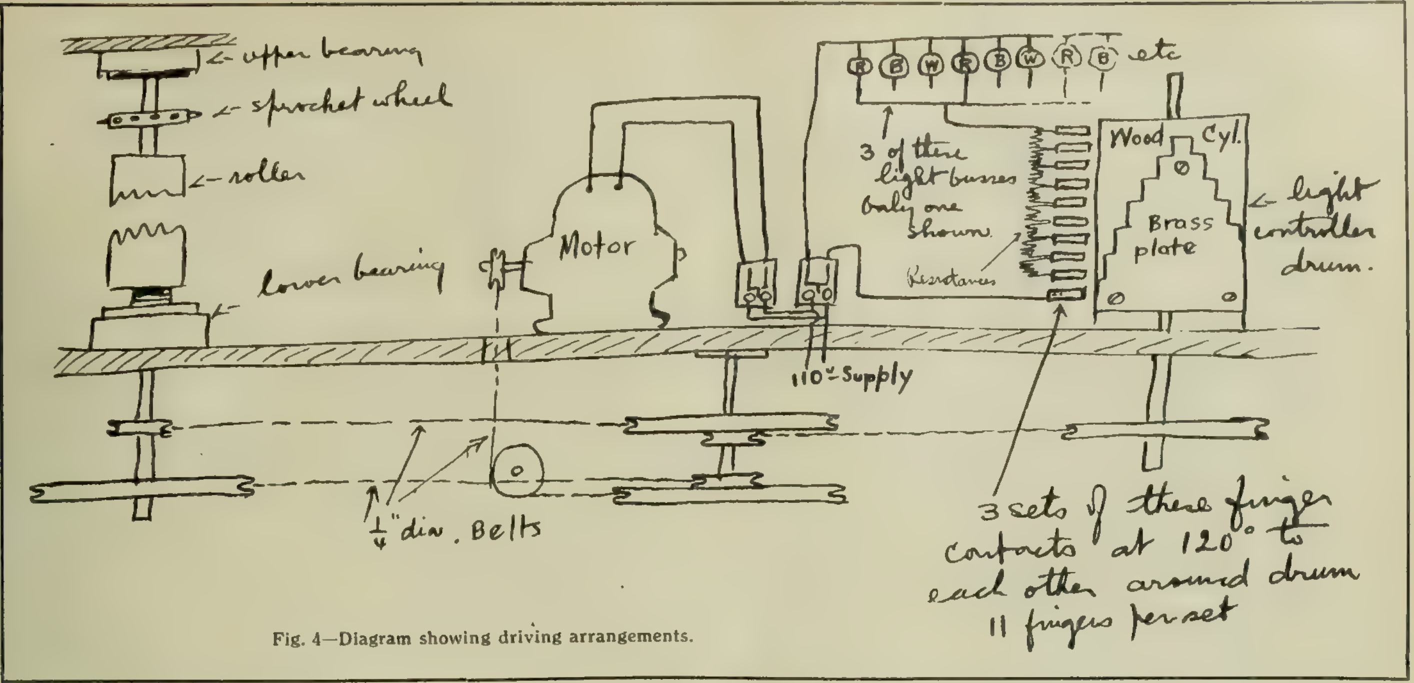


Fig. 4—Diagram showing driving arrangements.

so that a double reduction of speed from motor to sprocket wheel was made by means of a countershaft and intermediate pulleys.

The panorama is illuminated by 110 volt carbon lamps situated in troughs behind the top and bottom of the frame, between the frame and the panorama. These lights are divided into three interspaced banks of twenty lights each, one bank containing blue, another clear and another red lamps to represent the color of the early morning, noon and the evening respectively. The banks of lights are controlled by a cylinder operated indirectly by the motor; see sketch of drive arrangement, Fig. 4.

A combination of brass cylinder plate, 3 sets of finger contacts and 3 banks of resistances give the following cycle of operations: Starting with the blue lights on full, the rotation of the control drum decreases the blue light 10 per cent. at a step until the blue lights are out altogether, but for each 10 per cent. decrease of the blue light there is a corresponding 10 per cent. increase of the white light, so that when the blue lights are entirely off the clear lamps are burning full. Similarly, the while light decreases and the red light increases, the white light merging into red, and the red into blue, and so on. There is a complete change of color during every 10-foot movement of the canvas, and as the canvas is 50 feet long, it will be noted that any particular section of the canvas appears in a different light every time it passes before the frame opening.

The switching arrangements allow the panorama to be driven independently of the lights, but the cycles of colored lights can only be obtained while the motor and panorama are operated; that is, there is no clutch between the motor and the driving roller; but the motor can be stopped at any time without cutting off the colored lighting, which happens to be on at the moment the motor is stopped.

The apparatus was completed and shipped on June 19, 1917. Panorama was painted by Mr. Charles W. Simpson, Montreal; design of mechanical and electrical apparatus by Mr. H. F. Schippel, McGill University, and work done under contract with Henry Morgan & Company, Montreal.

The Chamberlain & Hookham Meter Company, College Street, Toronto, suffered a slight inconvenience by fire on the evening of Friday, August 17. The damage was quickly repaired, however, and by the following Monday the plant was in full operation again.

Employees of D. P. & T. Co. Have Good Time

The employees of the Light and Power Departments of the Dominion Power and Transmission Company, Hamilton, recently held a picnic at Grimsby under the auspices of the Hamilton section of the Canadian Electrical Association. The following work order, No. 41144, gave the necessary authority to prepare the "Bill of Trouble."

Dominion Power and Transmission Co.

Date, Friday, August 10th, 1917. Work Order No. 41144.

To Picnic Committee:

This order authorizes and directs you to conduct Picnic on above date, charging all labor and material expended to the above number and to Recreation Account.

At 1.10 p.m. board special H. G. & B. cars for Grimsby Beach.

Bill of Trouble:—

1	100 yards	Gents, open
2	50 yards, Zigzag	Ladies
3	Potato Race	Ladies and Gents
4	Needle Race	Ladies and Gents
5	Clothes Pin Snatching	Ladies and Gents
6	Nail Driving	Ladies
7	Rail Fight	Gents
8	Peanut Pushing	Ladies and Gents
9	Shot Putting	Gents
10	Ball Throwing	Ladies
11	Tug of War	5 Gents per team
12	Meter Reading	Ladies and Gents
13	Broom Hockey	Ladies, 4 to team
14	Base Ball	Gents
15	Special Feature	Who's the Goat?

CHAS. H. FRY,
Chairman of Picnic Committee.

Examined and approved by the following officers of the day:

Leo. V. Blatz, Grounds Committee; Charlie Choate, Sports Committee; Fred Gardiner, Transportation; Geo. Kendall, Prize Committee. Chaperones:—Mesdames Choate, Fry, Hutton and Kendall.

Results of Events

1. 100 Yard Dash, Men .. .W. Burtch
J. Hanley

2. 50 Yard Zig Zag, Ladies..J. Kellett
M. Cruickshank

3. Potato Race	R. Baker A. Miller S. Wolfenden M. Cruickshank
4. Needle Race	H. Hall and Miss Kellett C. H. Hutton and Mrs. Heatley
5. Clothes Pin Race	L. Deschenes Miss Strongman S. H. Wolfenden Miss Cruickshank
6. Nail Driving	Mrs. L. W. Pratt Mrs. Heatley
7. Rail Fight	Geo. Bentley W. Townsend
8. Peanut Race	J. Marwick Miss Strongman J. Williams Mrs. Heatley
9. Shot Putting	C. G. Choate Fred Gardiner
10. Ball Throwing, Ladies ..	Miss E. Sauer Miss Hunter
11. Tug of War, Winning Team	R. Corrigal, J. Wilbur P. Stanahan, W. Morris, C. Main
12. Meter Reading, Men ...	H. Hall, 70 Points G. Philips, 68 points Mrs. Hutton, 70 points Miss Strongman, 68 points
13. Broom Hockey Match for Ladies	Won by Mrs. Fry's team
14. Base Ball Match	Won by Line Construction Team

A very interesting event was the meter reading contest. Six meter dials were mounted on a board which was sealed up until the contest started, and over each dial was the name and address of a foreigner, such as:—Nicholas Michaelovitch, No. 1127 Nevsky Prospeckt. Five points were given for each correct name and address, five points for each correct dial reading, twenty points for the first to arrive at the goal, about two hundred feet from the meter board, with one point off for each successive runner.

The interesting fact developed that, among the contestants at any rate, the ladies were more dependable than the men in getting correct names, addresses and readings. The men were required to put down the readings in figures, the ladies to mark the position of the hands on duplicate dial charts.

New Home of B. C. Telephone Co., Limited Vancouver

Another convincing proof of improving conditions in the building line in Vancouver is contained in the announcement that the British Columbia Telephone Company, Limited, has decided to proceed with the construction of the new head office building on Seymour Street, between Georgia and Robson, the tender of the local contracting company of Adkison & Dill, Ltd., having been accepted for continuing the work. The building will have a steel frame and be eight storeys high, with a basement. Provision has been made for a future ninth storey.

The ground floor will be occupied by the commercial department. The public space will be approximately 1,500 square feet, from which there will be access to the elevator, stair hall, long distance booths and cashiers' cages. The rest of the floor will be taken up by the sales and recording departments, and the manager's and superintendent's offices.

The main staircase will be at the front of the building, entered direct from the public space or from Seymour Street. This doorway is intended partly for a main exit and for the public at busy hours and for the company employees' entrance. The main stairway leads to the second floor, where an additional elevator is placed, serving all upper floors.

The five upper floors, second to sixth inclusive, will house the central exchange equipment, in the following manner: Second floor, toll switchboards and locker rooms; third floor, first unit switchboard; fourth floor and mezzanine, rack room; fifth and sixth floors, second and third units respectively. The seventh floor will be furnished as the operators' rest room, cafeteria, dining room, kitchen, lavatory and hospital. A special feature of the rest room will be a large open fireplace and well arranged seats.

The general office will be placed on the eighth floor, together with the board room, secretary's and private offices for the various departments. The general office and public space will occupy about 2,250 square feet.

The front portion of the roof, which will be reached by stair and elevator, is intended for a roof garden for the staff.

Ample heating and storage facilities will be provided in the basement, where will be situated also the cable vaults and engine room for auxiliary power.

Concerning the face of the building, the lower part of the Seymour Street front will be of granite, surmounted by pressed Roman bricks for five storeys. The top storey will be faced with terra cotta, with copper cornice. The remaining elevations will be of pressed brick. The interior finish in the main offices and public rooms will be in keeping with a building of this class. Oak and marble will prevail, and, wherever possible, local materials will have the preference.

The chief purpose of the building, it must be stated, is, after all, for the central exchange, and the plans show that every care has been taken to ensure the most modern ideas in telephony, embodying all the latest principles and quite in harmony with the progressive policy of the company's directors towards superior service to the subscribers.

Correction re Bridge River Power

Vancouver, B.C., August 14, 1917.

Editor, Electrical News:—

In my letter to you of June 13th (published in Electrical News, July 1, p. 34) in reference to Bridge River and Cheakamus River water powers recently submitted to the city of Vancouver, I wish to make a correction in the sixth paragraph, which should read as follows:—

"From the plans submitted there is no evidence that the Bridge River scheme can produce more than 200,000 h.p. of continuous energy from the storage available and shown on the plans referred to, there being a mean storage area by following the 90 ft. contour line of 950 acres, giving by a 150 ft. dam about 60,000 acre feet, and the government records of stream flow (see page 169, Water Resources Paper No. 14 for 1914) show that this river required in that year 1,213,000 acre feet storage to maintain the mean flow of 4,116 second feet."

This correction is self evident on referring to the page in question, and it is fair to state that Mr. Bonnycastle estimates that about 638,000 acre feet storage is required to obtain a development of 400,000 h.p., and that with further surveys he expects to use several lakes available for additional storage.

Yours sincerely,

H. K. Dutcher.

Montreal Aqueduct Power Development

Further Report by Original Committee Favors Completion of Scheme 2 in Preference to Purchase from Private Company

A further report on the Montreal Aqueduct-Power Development scheme has been made by the board, consisting of Messrs. A. G. Vautelet, A. St. Laurent and J. B. McRae—the original committee—this time to consider particularly the tender of the Civic Investment and Industrial Company for the supply of electric power. The Board was unable to agree, the two first mentioned being of the opinion that Scheme No. 2, as originally outlined in the Electrical News, viz., for a maximum power development representing 24,500 h.p. in summer, 13,000 h.p. in winter, and a $10,609,000 expenditure, would be more advantageous to the city than the purchase of power from the private company. Mr. McRae dissented from this view. The report of the Board is as follows:

Montreal, August 18th, 1917.

Gentlemen:—

According to instructions from the Board of Commissioners, our Board met in consultation with Dr. Herdt to consider the tender of the Civic Investment & Industrial Company for the supply of electric power to the city, and our Board also considered the offer of the Cook Construction Company, either to do any work connected with the aqueduct project at cost plus 15 per cent., or to abandon their contract waiving their right to anticipated profits.

Our Board is unanimous in recommending that the contract with the Cook Construction Company be cancelled as per the terms of their letter of July 17th, 1917, and that their offer to do the work at cost plus 15 per cent. be rejected.

Our Board in consultation with Dr. Herdt calculated that, according to the new specifications and tender of the Civic Investment Company, the cost of purchased power for pumping an average of 100 M.I.G. per day would be $235,585 per year.

From a letter of A. B. Cook, dated July 17th, 1917, it was ascertained that the said Cook Company were willing to waive their rights to anticipated profits. The cost of work to be done if hydraulic development be abandoned was, therefore, diminished by $279,575. On the other hand, since December 31st, 1916, work has been done and undertaken for an amount of $185,225. The total cost of buying current was, therefore, diminished by $94,350, and the interest thereon by $4,718. The total cost per year for the operation of the pump house at Atwater Avenue and of the filtration plant for an average consumption of 100,000,000 imperial gallons was, therefore, reduced from $656,000 to $606,991, and the cost on h.p. basis from $62.47 to $57.81.

We would call your attention to the letter of the Civic Investment & Industrial Company, accompanying their tender, and more especially to clauses "d" and "g."

Clause "d" might be interpreted as meaning that a minimum of 8,000 h.p. must be used at Atwater Avenue and the wording of the beginning of the clause re minimum payment is not clear.

Clause "g" may be interpreted as meaning that to the prices mentioned in the tender must be added the taxes: Municipal, Provincial and Federal other than existing municipal taxes. This should be made clear and the proportion of said taxes, if any, chargeable to the city should be determined in advance.

It remained for the Board to decide whether it would recommend to the city to accept the tender of the Civic Investment Company, or to go ahead with the hydraulic development as per Scheme No. II.

After discussion it was found impossible for the members of the Board to agree, and it was, therefore, resolved to make two different reports on the final recommendation to be made in addition to the recommendations and findings of the report of April 30th, 1917.

(Signed) H. E. Vautelet, Chairman.
A. St. Laurent.
J. B. McRae.

The Majority Report

Gentlemen:—

Remarks on the tender of the Civic Investment & Industrial Company.

The calculations of the cost have been made on existing data for the monthly peak load for periods of 2½ and 3 hours. As the specifications call for payment on maximum monthly peak load for a period of 20 minutes, the sum to be paid may be larger than calculated.

The indefinite amount of taxes to be paid in addition to the contract prices may also make an appreciable difference.

We are also of opinion that the provision made for heating the filtration plant is inadequate and will further increase the cost of buying electric current.

As the average monthly peak load calculated is 1.16 of the average consumption, it follows that the minimum price paid by the city for power actually used will be 1.16 x 26.50 = $30.74 per e.h.p. and the total cost per h.p. will be $57.81.

It must be remarked, however, that the annual amount of $235,585 will have to be paid only when the water consumption of the city reaches 100,000,000 imperial gallons per day, and that until that time the power bills will be smaller, but after that time will gradually increase with the increased consumption of water.

The abandonment of the hydraulic development will necessitate a capital expenditure of $1,500,000, the greater part of which need not be immediately made.

It will also necessitate the immediate expenditure of $373,000 for the construction of the electric pump house.

Remarks on Scheme No. II.

If it is decided to go on with the hydraulic development as per Scheme No. II., it will not be necessary to prosecute the word immediately and it will be better to wait until the cost of labor and material has become normal again.

In the meantime, the city can continue to pump the water by steam.

It is, however, necessary to insure the supply of water in case of an accident to the conduit. This has been provided for to a certain extent by the emergency supply from the Lachine Canal, but that supply can only be resorted to for a short period.

To insure it more completely, it will be necessary to be able to draw the water from the aqueduct canal and, therefore, to build a dam at the site of the old power house, so that the canal may be filled up in case of need.

We think the best way to do this would be to put in the foundations of the power house at a cost of $100,000, and to proceed with the rest of the work as circumstances will allow.

The cost on h.p. basis as mentioned in our previous report will be $56.90 when the average consumption of water is 100,000,000 imperial gallons per day, but until such time it will not be necessary to have all the works completed and the annual expenditure will be less.

It must be remarked, however, that when that average consumption becomes larger than 100,000,000 imperial gallons per day, the cost on h.p. basis will diminish to $50.35, as mentioned in our previous report, and that the city will have an additional power of 11,500 h.p. at a cost of $5.06 per h.p., or $6.75 per e.h.p during seven summer months.

From the previous remarks we conclude:

(1) The cost on h.p. basis for the buying of current ($57.81) is larger than in the case of Scheme II. ($56.90).

(2) When the consumption of the water by the city is larger than 100,000,000 imperial gallons per day (probably in 10 years), the cost on h.p. basis for buying current will remain the same ($57.81), whereas in the case of Scheme No. II. it will diminish ($50.35).

(3) During seven months of summer Scheme No. II. will give the city 11,500 additional h.p. at a cost per e.h.p. of $6.74 per annum, whereas it would have to pay $15.46 for that same power to the contractor.

(4) In the case of purchased power, the boulevard scheme as proposed has to be abandoned. Though we cannot attach a tangible value to the boulevards, they certainly will be a benefit to the city.

(5) The immediate capital expenditure necessary in both cases will be about the same.

We Therefore Recommend:

That the city proceed with the hydraulic development of the Aqueduct as per Scheme No. II.;

That the foundation of the power house be built as early as possible to insure the water supply of the city;

That the balance of the work be proceeded with as circumstances will allow.

(Signed) H. E. Vautelet,
A. St. Laurent.

Electric Steel Furnaces in England

From time to time we have printed items and articles of a more or less historical nature on various types of electric steel furnaces. Comparatively little has been published on their operation because the steel furnace is to all intents and purposes merely in its infancy and, as such, is almost certain of tremendous improvement and development during the next ten or twenty years. England, probably more than any other country in the world, has developed her electric steel industry during the last three years and has tried out practically every type of furnace. One of these about which comparatively little has been written is the Greaves-Etchells type, the construction of which is illustrated herewith. This illustration and the description which accompanies it is taken from a recent issue of the Electrical Review, from an article by Mr. E. Kilburn Scott, Assoc. Inst. E.E., M.I.E.E. The following is from Mr. Scott's paper:—

Since the war, one of the most striking developments of the steel industry of Great Britain has been the rapid increase in number of electric steel furnaces; so successful have they been that the prejudice against this type of furnace is rapidly disappearing and the change will probably rank as the most radical one since the time of Bessemer.

For the manufacture of high quality steel castings the electric furnace is ideal. The superiority of electric steel castings over those made by any other process has been conclusively proved by the extremely severe conditions to which these castings have been subjected under specialized war conditions. The castings produced can be finished off dead mild, and a 1-inch square bar can be bent double at cast, no expensive annealing operations being necessary. The carbon contents usually vary between .2 per cent. and .25 per cent., while the sulphur and phosphorus are each reduced below .015 per cent., and manganese and silicon are adjusted to suit the work.

The tensile properties of ordinary electric cast steel are:

Maximum tensile strength ... ... 35 tons per sq. in.
Yield point ... ... 25 tons per sq. in.
Reduction of area, 50 per cent. Elongation, 30 per cent.

The maximum tensile stress can be readily increased to even 100 tons per sq. in. by the introduction of special elements, such as nickel, chromium, and vanadium

Many works that sell their steel swarf and scrap, cast-iron borings, etc., at very nominal prices, and purchase all their steel castings, could very profitably install an electric furnace and make their own castings from the scrap. The charge can be made up entirely of scrap and turnings; no expensive raw materials are necessary. The melting loss is almost negligible, while in other processes it is from 7 per cent. to 15 per cent.

Steel from the electric furnace is finished off under a reducing atmosphere of carbonic oxide and a slag out of which the metallic oxides have been reduced, and is singularly free from blowholes when properly cast. This is due to the elimination of the gases that molten steel usually holds in solution, and the ease with which the steel can be poured into small and intricate moulds, flowing smoothly like milk, and setting perfectly quietly, is largely due to its purity.

For small, light castings, furnaces of not more than 30 cwt. are recommended; steel of such low carbon content has a high melting point, and must be cast at a very high temperature, and though the temperature is easily obtainable in the furnace, difficulties occur in handling large quantities of such hot metal in ladles if a large number of castings are to be made. For small, mild steel castings—many of which have proved a better substitute for malleable iron castings—smaller furnaces are recommended, and several firms have installed furnaces of 10 cwt. capacity to melt steel for small engine parts of motor cycles and motor cars instead of using stampings.

Where large quantities of good quality steel are required "The Hot Metal Process," as it is called, combines cheapness and quality. It has been adopted extensively in the United States. The metal is first heated in a basic lined, tilting, open-hearth furnace of large capacity, and it then run into a number of electric furnaces for final refining and addition of alloys. The process is continuous, and as the energy for the first melting of the steel is obtained direct from fuel, the amount of electrical energy is only that required to maintain the temperature during refining and the assimilating of the alloys. Steel so produced commands high prices.

Electric furnaces are used for the melting of ferro alloys for open hearth and Bessemer plants, as it is found much more economical to make alloy additions in the molten form. The electric furnace is ideal for this.

Types of Furnaces

As the earlier furnaces were for small outputs, single-phase alternating current was used, and to obtain a balance on a polyphase supply several furnaces had to be worked together.

Polyphase furnaces are better than single-phase furnaces, because for a given output of steel one such furnace is cheaper, takes up less room, and requires less attention than several single-phase furnaces. With single phase, if one arc fails the circuit is broken, and the load falls to zero. This is liable to happen during the melting-down period, when the pieces of scrap metal change position under the electrodes.

Some arc furnaces have all the electrodes above the bath of metal, one of this class being the Heroult. As arranged for three-phase supply it has three vertical electrodes through the roof, and the arcs are between each electrode and the bath, so that the molten metal forms part of the electrical circuit. Two furnaces, namely the Girod and the Snyder, employ water-cooled steel studs, which pass right through the bottom or hearth. As the ends of the studs project into the metal of the charge they burn away, and have to be renewed at intervals. This form is also not good practice, because of the danger of the metal finding its way through the hearth, and the liability of trouble with water connections. It will be noted that in all the above-named furnaces the refractory material of the hearth does not require to carry current. The material may be, therefore, either acid (silica) or basic (magnesite).

The Greaves-Etchells Furnace

Another furnace which has met with considerable success is that of Greaves-Etchells, more than 30 having been installed or put under construction since January, 1916. This is an all-British production, both in inception and manufacture. It is designed to operate on a three (or two) phase supply, and has two of the phases connected to electrodes above the bath, the third phase being connected to a copper plate below the electrically conductive hearth of magnesite.

The roof is made of silica bricks, as these are fairly good insulators. They are set in a steel framing which rests on the silica brick walls projecting above the steel body of the furnace. The roof is domed and brought as low as possible, so as to reduce the wasting away of the electrodes by the action of the gases. A roof will last about 100 heats, and a duplicate one is provided with each furnace, so that the steel melting can be carried on, except for the short time taken to change the roof.

In order to obtain an even temperature through the bath of molten metal in the electric furnace, it was realized that heat must be applied below, as well as above, the bath, and in order to effect this the hearth of the furnace is specially constructed.

Above 12 per cent. of the total energy of the Greaves-Etchells furnace is used in the hearth, and the "bottom heating" which results is found to be of great advantage in melting down alloys. The heavier alloys—chrome, tungsten, vanadium, and nickel—sink to the bottom of the bath, and if there is no bottom heating are apt to remain for a considerable time in a semi-fluid state.

The hearth lining is never less than 20 inches thick, and is constructed mainly of dolomite and magnesite, in such a manner that the electrical resistance is high at the inside of the bath in proximity to the charge, and decreases rapidly to a negligible quantity at the outside. The current flowing through the hearth generates a considerable amount of heat immediately below the liquid in the most efficient manner possible, while the electric arcs arranged over the bath maintain the slag and surface at the desired temperature.

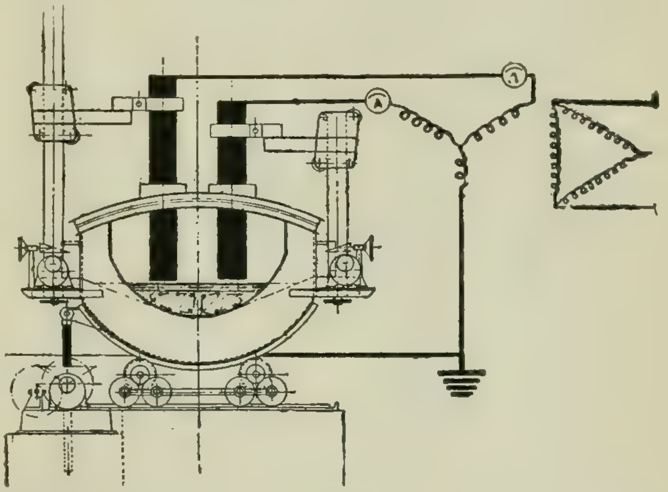
The effect of this bottom heating is to cause convection currents in the molten metal, which ensure a constant circulation, and a uniform product. The outside of the furnace bottom remains cold, little or no heat being lost in this direction.

This system of connection at first sight would appear to cause an out-of-balance load on the primary supply, but the system of transformer ratios is arranged to give a perfect balance when the upper electrodes are in equal adjustment.

Half-ton Charge in Two Hours

The Greaves-Etchells system of transformer connections is such that the short-circuit current of one electrode must traverse two transformers in series and in different phase, which automatically lowers the power factor momentarily, and has a very strong buffer effect; the fact that there is always a permanent resistance in the path of the current through the hearth also limits very considerably the effects of short circuits. The combination of these factors provides the most effective means yet devised for protecting the supply system from shock, while allowing a high power factor to be obtained on normal load.

For the manufacture of high-speed steels or special alloy steels, a ½-ton or 1½-ton furnace is usually adopted, and the former can finish a charge from cold material and alloys in two to two and a half hours, with an energy consumption of 400 units.



Section through six-ton Greaves-Etchells furnace showing circulation of metal.

To make up a charge from scrap, it is usual to place steel turnings and millings on the hearth, then pieces of bar and rail ends, tube ends, and finally large pieces of steel. The interstices between the large pieces are filled with turnings, etc., and some iron ore may be added. The amount of iron ore depends on the amount of iron oxide present in the form of rust on the scrap.

As the charge is melted, a slag of lime and fluorspar is made in order to eliminate the phosphorus as phosphate of lime. After this phosphate slag has been skimmed off, a new slab is made of best Buxton lime, fluorspar, and white sand in the proportions of 30, 10, and 5. When this has fluxed, a small quantity of finely powdered anthracite coal is spread on the slag, and this is continued until the slag is deoxidised.

The steel is thus finished off under an atmosphere of carbonic oxide and a slag out of which the metallic oxides have been reduced. When entirely deoxidized a sample of slag falls to a fine white powder as it cools. Deoxidisation of the slag results in deoxidisation of the steel, through the constant reduction of silicon from the slag, and it may be hastened by addition of small quantities of ferro-silicon.

History and Progress of Electro-Culture

Earliest Experiments in Eighteenth Century—England Chiefly Instrumental in Getting Results—Description of Latest Types of Apparatus

The early experiments go back to the eighteenth century. One of the original workers was a Scotsman, who subjected myrtles to a discharge from a frictional machine, and was led to the conclusion that it acted as a stimulus to growth. More elaborate experiments are to be credited to the Abbe Nollet. There was also the experiments of the Abbe Berthelon, who dabbled with the question in 1783. At a later date experiments were put in hand in France by Professor Berthelot at the station for Agricultural Chemistry established at Meudon. The effect of silent discharge was then tried, and the theory was put forward that the clue to the advantage of employing an electric discharge was the influence of atmospheric nitrogen on the plant metabolism. There are many records of work which has been carried out in this country and on the Continent, but the modern development of the subject dates from the practical experiments which the late Professor Lemstrom, the Swedish scientist, commenced in the year 1885. Whilst travelling in the Arctic Circle, Professor Lemstrom was impressed by the remarkable development of vegetation in Polar as compared with more southern regions, and he was led to attribute this to the large amount of electricity present in the air at that part of the earth, an impression which was strengthened by the fact that experimental reproductions of the Aurora Borealis in his own greenhouse appeared to have an extraordinary influence on plant growth. The experiments on a larger scale which Professor Lemstrom subsequently carried out in Finland, in Burgundy, in Germany, and at Durham University gave positive demonstration that the application of electric discharge had a marked effect on the yield of various crops. All the common vegetables and cereals, as well as strawberries and raspberries, were the subject of experiment. Professor Lemstrom's method was to erect a wire network consisting of fine iron wires spaced at intervals of 4 ft. at a height of 16 inches above the ground, the height being increased as the crops grew. The wires were provided with points something like those on barbed wire, and the network was charged by an influence machine of Professor Lemstrom's own design.

At the meeting of the British Association in 1898 Mr. E. H. Cook described some experiments he had conducted with the discharge from the negative pole of a Wimshurst machine. These tests aimed at the direct utilization of atmospheric electricity. Experiments were also made by Baron Adelsvard in Sweden in 1902 and 1903, and at Breslau in 1902. Dr. H. G. Dorser has made tests in America, employing a Tesla alternating discharge with apparently good effect. Demonstration was then given that the electricity must be applied to the aerial portion of the plant and not to the soil. There are also data available on the negative side, Grandeau having demonstrated that plants protected from atmospheric electricity had their development greatly retarded.

Many Experiments with Different Apparatus

Lemstrom was certainly the pioneer of the modern school, and his type of apparatus was used by early experimenters in Great Britain and elsewhere, but doubts have been expressed by some of the workers in this field, notably by Mr. J. E. Newman, who carried out some experiments on the Lemstrom plan at some nursery gardens at Bitton, Bristol, in 1905, whether the apparatus as originally designed did in every case succeed in ionising the air to an effective extent. It is suggested, indeed, that leakage over the insulation on damp days would, in some of the larger scale trials, have absorbed the small amount of current generated. Mr. Newman did succeed in Bristol in obtaining results which suggested that the application of electricity was one which should be further investigated, but he reached the conclusion that the influence machine was quite unsuitable for the work. It was obvious, too, that the close network of wires near the ground would interfere with essential farming operations. A well-known engineer who was attracted by the problem was the late Mr. B. H. Thwaite, and he, it will be recalled, carried out some experiments, chiefly by means of the electric light. Professor J. H. Priestley has done a great deal of work in this field, and in a paper published in 1905 described some of the important results reached. Mr. Ingvar Jorgensen, who is now working in conjunction with Professor V. H. Blackman at the Imperial College, carried out experiments at the Danish Government Agricultural Experimental Station at Copenhagen, and subsequently worked with Professor Priestley, who at that time held an appointment at University College, Bristol, and was afterwards transferred to Leeds University.

Real progress, however, may be said to date from the alliance between Mr. J. E. Newman and Sir Oliver Lodge. Realizing that the influence machine was unsuitable for the purpose, Mr. Newman had recourse to Sir Oliver's method of generating high-tension electricity, and it is the Lodge-Newman system which has been employed in most of the recent experimental work down to the present time. The latest type of apparatus is illustrated in Fig. 1. Under this system alternating high-tension current is generated by an induction coil, one terminal of the secondary being connected to earth, and the other to the discharge network through a series of Lodge rectifiers. The apparatus which is now in use has only been evolved through a long process of trial and error. The original set made use of an ordinary X-ray coil with high-tension mercury vapour rectifiers, but both the coil and the rectifiers failed under service conditions. The Lodge valve, which is used in the apparatus at present supplied for agricultural purposes, has been modified in details from time to time, but it remains essentially the same in principle as when it was first introduced, and the latest form may be regarded as reliable.

In the latest type of apparatus for agricultural works two sets of valves are arranged in parallel, the current being distributed to them by a rectifier driven off the shaft of the mercury gas break. The coil is water cooled, and the use of perishable material is avoided, to eliminate as far as possible the risk of breakdown, and with the fact in mind that if electro-culture is to become common practice the installation will frequently have to be handled by those unskilled in the use of electrical apparatus. The ammeter with the primary current which is usually supplied generally shows that 2-3 amperes are used in the primary of the coil, with the sparking distance at the field spark gap, indicating the potential difference between the wire network and earth, between ½ in. and ¾ in. A set of valves will pass enough current to charge a network of from 25 to 30 acres. It may be pointed out that the same type of apparatus has given satisfactory service in fume deposition work, where the conditions of operation are far more severe than in agricultural operation. In recent agricultural installations the supply current is 100-250 volts direct-current, and the working pressure 120,000. Continuous current has been adopted for this work because it resembles the normal atmospheric electrification, and because experience suggests that positive electricity produces better results than negative. There is some evidence, however, that leguminous plants prefer the latter.

Method of Application

A general method of applying the discharge to the area planted is as follows:—Over the area to be electrified is erected a wire network consisting of thin galvanized steel wire, run, preferably, at an average height of 15 feet above ground, in order not to interfere with harvesting operations. The wires, spaced ten yards apart, are carried on span wires between stout telegraph wires on insulators mounted on posts planted about 70 yards apart in parallel rows about 100 yards apart. The wires are carried by specially designed insulators, to withstand the high potentials employed. Those over the field are not attached to the main insulators at all, except through ebonite rods or looped porcelain insulators.

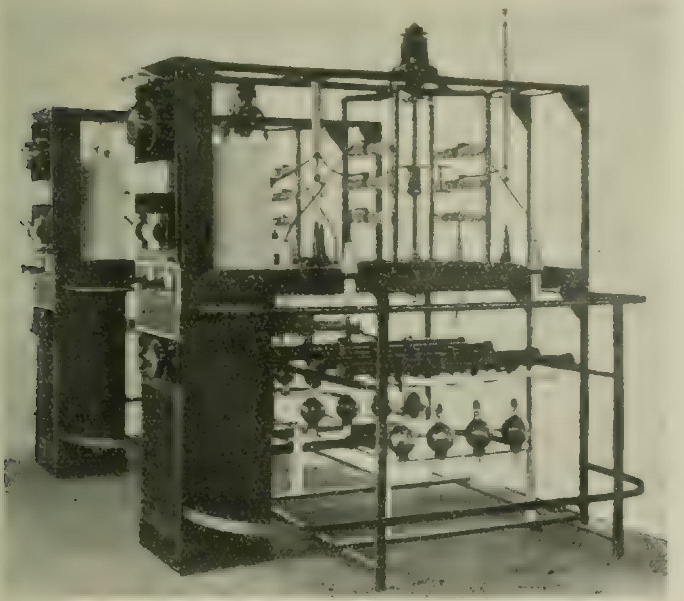


Fig. 1—Latest type Lodge-Newman apparatus.

Coming to the consideration of the practical work done on the subject during recent years, the two sets of experiments which attract attention are those carried out by Mr. J. E. Newman at Salford Priors, Evesham, between 1906 and 1911, and the work of Miss E. C. Dudgeon at Lincluden, Dumfries. In the Evesham experiments about 19½ acres were covered with the wire network. The results attained over the series of years appear to be quite conclusive as to the beneficial effect of the electrical discharge on crop growth. It is true that in 1911, a year of drought and prolonged sunshine—conditions altogether against the use of electricity—the results were negative. In 1906 the increased yield from wheat in the electrified area was between 29 and 39 per cent., and from barley 5 per cent. In 1907 the gain in the wheat crop was 29 per cent., or 9.4 bushels per acre; in 1908, when wheat was again planted, 24.3 per cent., or 5 bushels per acre, over a similar crop grown adjacent to the electrified area, were secured. These results were repeated in other years with the exception of 1911. With fruit and vegetables the results were a little variable. Mr. Newman had obtained in his Bristol experiments gains of 17 per cent. in cucumbers, 36 per cent. in strawberries—five year old plants—and even better returns with younger plants. Celery, on the other hand, only gave a 2 per cent. increase, and tomatoes no gain from the application of electricity, while broad beans were reduced in yield 15 per cent., but were ready for picking earlier. At Evesham the improved yield of mangolds was estimated at 25 per cent. The Bristol results with strawberries were repeated, and raspberries showed a marked improvement in growth in the new wood. Here, too, there was a gain in the yield of tomatoes. Mr. Newman, who is now on special leave from the army, which he joined at the outbreak of war, has begun experiments with electrified crops on his own farm. The electrified area for the present season is only two acres, owing to the fact that Mr. Newman only commenced the work about three months ago. One acre of wheat and one of mangolds is being grown against similar crops in special adjoining control areas. The generating plant is a 4 horse-power Lister internal combustion engine using petrol as fuel, but it is also employed to provide power for the ordinary farm work. The engine drives a 1-kilowatt dynamo, and the ordinary Lodge apparatus is employed. The plant at Pershore was set in operation this year on May 20th, and as all the accumulated experience suggested that intermittent application yielded the best results, the discharge has been applied on that system. In the middle of June, there was, even at that early period, a slight but perceptible difference in the crops grown under the influence of the discharge. Further data as to the actual results will be available at a later date.

An interesting fact, which has been noted by earlier observers, and to which reference may here be made, as it has been confirmed by Mr. Newman's work, is that many atmospheric impurities will move under the influence of the potential gradient under the wires, and in industrial districts will lead to the precipitation of many harmful substances on the plants. It has been noted that in greenhouses near large towns the discharge results in a serious deposition of dust on the glass, enough sensibly to interfere with the amount of light, and to make the prospect of successful application in greenhouses quite doubtful.

Results at Lincluden

Miss Dudgeon's experiments, carried out partly in conjunction with the Board of Agriculture, are of considerable interest. Beginning in the year 1910 with an experimental area of about a quarter of an acre she has continued the work down to the present time. In 1911, in conjunction with a local farmer, Miss Dudgeon was able to obtain comparative results from an area of seven acres, half of which was electrified and the other half used as a control. The crop was potatoes, and the extra weight per acre from the electrified plot was 1 ton 9 cwt. 2 quarters 20 lb. In 1915 and last year oats were chosen as the experimental crop at Lincluden, a large field which had given uniform crops in the past being selected. Apparatus of the Lodge-Newman type—the present installation is illustrated in Fig. 2—has been in use throughout at Lincluden. Last year, with the object of confining the discharge to the special area to be electrified, the height of the wires was reduced. They were placed at a height of 7 ft. and 4½ yards apart, and owing to these changes the intensity of the charge received by the crop was much increased, notwithstanding the employment of a lower voltage. Professor V. H. Blackman and I. Jorgensen, in their report on the results, state that the electrified areas, compared with the control areas, gave an increased yield of 20 bushels of grain—14 bushels of first quality and 6 bushels of second quality— and 2,395 pounds of straw. Calculating the percentage increase over the two control areas the following result is reached:—Increase in grain 49 per cent.; increase in straw 88 per cent. After making allowance for the large experimental error inherent in agricultural experiments where the number of plots is small, it is clear that these results taken in connection with those of 1915 demonstrate that under the conditions of the experiments oats respond very markedly by an increased yield both in grain and straw to the action of the overhead electric discharge. A new and important aspect of the problem has been disclosed by the discovery through recent experiments that the application of the discharge one year may increase the size of the crop the next year, i.e., there may be a marked after effect. If in addition to an immediate increase of the treated crop the electric discharge may also benefit a succeeding crop, it is obvious that the agricultural value of the application of the discharge becomes very much enhanced. The apparatus which has been used to produce the necessary high-tension current is, however, regarded by these authorities as comparatively inefficient, and not such as would be used for work on a large scale.

Mr. William Lowe, who has been carrying out experiments at Balmakewan, Kincardineshire, after obtaining some fairly satisfactory results in earlier years, only obtained indecisive results in 1916. The opinion of this worker, who had attempted to apply the electric discharge method to ordinary farm practice, is that the electric radiation only acts as a stimulus when the plant is in active growth.

Tried Out in Germany

Of the recent experiments abroad, those in Germany may be mentioned. They illustrate the readiness of our great trade rivals to test any new invention or method of working. Almost before the Agricultural Electric Discharge Company reached the stage of having applied the Lodge method of producing high-tension current tension to farm work, Professor Breslauer, who had been engaged in electrical engineering in England, realized the significance of the movement, visited the Evesham installation, became the German agent of the company, and in a very short time obtained orders for more sets. Six sets were delivered, and Mr. Newman, who visited Germany in connection with this work, is able to give some information as to the work done. One set was installed at Herde in East Prussia, one at Halle in Central Germany, another at Prague, and the others elsewhere. Two of the installations obtained quite good results, an increase of about 25 per cent in the crop yields being reported, sugar beet being one of the crops. In this case there was a proportionate increase in the sugar content. A set has also been sent out to Java for tests on sugar, but no information is available as to results, and another set, we may add, has been sent to the United States Bureau of Agriculture at Washington.

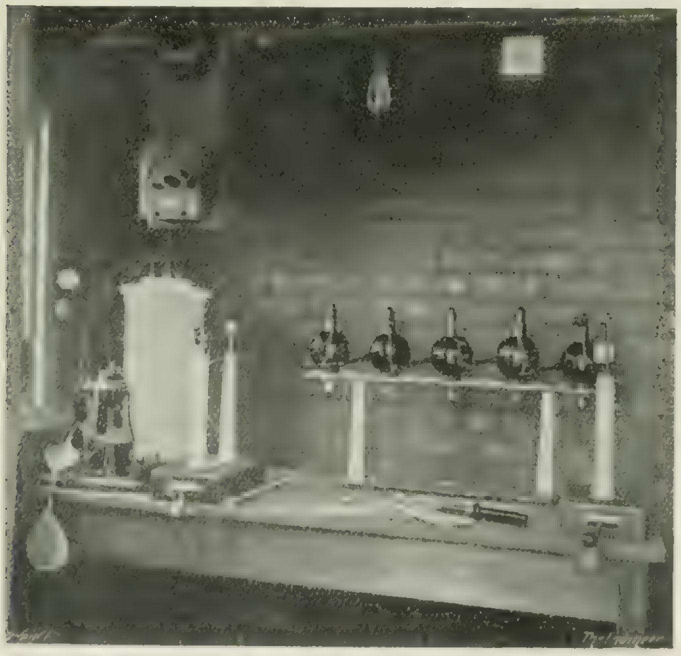


Fig. 2 Apparatus at Lincluden.

The work, which is to be undertaken on behalf of the Board of Agriculture, is designed thoroughly to test the effect of electricity on plant growth, and a grant for the purposes of this research has been made by the Development Commissioners. It is generally agreed that before the use of the overload electric discharge can be recommended to farmers more knowledge on many points must be available. One point may be emphasized: it is deemed desirable to test various methods of producing the necessary high-tension current.

The work which is being put in hand at Hereford on behalf of the Board of Agriculture by Professor Blackman and Mr. Jorgensen, in conjunction with Mr. W. T. Kerr, the city electrical engineer, and with the co-operation, it is understood, of Mr. Newman, will include an experimental area of 60 acres of various crops, and the test of a different type of discharge apparatus and design of equipment. The first overhead equipment on the Huntington Court Farm, which has been selected for the experiments, is to be 8 ft. from the ground. For main side poles 8 in. butts, 14 ft. high, are being employed, one set placed in concrete blocks in the hedges so that the poles can be removed during harvesting operations. In the fields movable light poles set 130 yards apart are to be used, and these poles will carry a pin-type insulator supporting the main wires, the side poles carrying suspension link-type insulators horizontally attached to a turnbuckle. The fine distributing wires of 30 S.W.G. will be spaced about 4 yards apart. The positive discharge from the machine is to be connected up to the main suspension wires and the negative well earthed. Experiments have shown that the weight of the end wires and use of the turnbuckle pulls the light wires and keeps them taut. The comparatively low height of the discharge network will enable a low pressure to be employed, probably 60,000 volts. The first discharge apparatus to be used is of the Snark type, supplied by Messrs. Newton and Wright, which is to be tested at this and other experimental stations. Mr. Kerr has himself been working for several years with a garden equipment consisting of a 10 inch coil and mercury break apparatus, but he is anxious to develop a more suitable apparatus for general use in commercial agriculture. Owing to the late start it is not likely that much can be done at Hereford this season except with swedes.

Experimenting on 15½ Acres

At Chester Mr. S. E. Britton, the electrical engineer, who is chairman of the Committee on the Development of Electricity in Agricultural Areas, formed by the Incorporated Municipal Electrical Association, of which Mr. Kerr is also a member, is carrying out experiments with electro-culture on three separate areas of 1½ acres, 10 acres, and 14 acres respectively. The 1½ acre area, which was equipped at the beginning of June, is planted with garden produce; the 14 acres area, which was equipped at the end of June, with potatoes, mangolds and swedes; and the 10 acres area, which was completed in July, has been planted with oats. The apparatus used in connection with the 1½ acres area is a Sanax motor interruptor, Leslie Miller 10 in. coil, and Lodge rectifiers; the 10 acres are operated with apparatus supplied by the Agricultural Electric Discharge Company, which consists of a heavy discharge coil, motor-driven gas current interrupter, and five Lodge valves; the 14-acre plot is equipped with a 12-in. heavy discharge coil, motor-driven mercury-driven interrupter supplied by Messrs. Harry Cox and

Company, Limited, and four Lodge rectifiers. The current is carried from the apparatus to the field by bare galvanized wire, strained from wooden poles, and insulated with high-tension strain insulators, to which are attached discharge wires of No. 30 S.W.G. steel wire. The source of supply in each instance is direct current.

The main object of testing different types of apparatus is, that at the present time the question of cost may prevent many farmers from making practical tests. The first outlay in applying the Lodge-Newman system to 24 acres has been estimated at £300, with an annual upkeep of £63, while the plant for 300 acres would cost £1,500. These figures rule out the system for grass farms, and limit it, until the financial outlay can be reduced, to fruit and other special farming where the financial yield per acre is high enough to make it possible to bear the initial cost of an electrification scheme. It is, however, possible for those who desire to make tests on a small scale to obtain small experimental sets, including switchboard, regulating resistance, switches, etc., mercury gas interrupter, induction coils with spark gap, four Lodge valves and accessories for about £70, and a good many sets of this type have already been supplied. This is not, however, practical farming, and if the work now in progress yields definite information on some of the disputed points, the application of electro-culture to large scale farming that the Board of Agriculture desires to bring about may result. What is being done both from the engineering and the agricultural standpoint will be followed with the keenest interest by all who recognize the new importance which must be attached to the agricultural future of Great Britain. No lesson of the war is more insistent than that more of our food requirements must come from home sources of supply, and if electro-culture can be applied with the certainty of increased yields as compared with ordinary farming, and at costs which do not prohibit their extensive application, it would prove a national gain of no small value.

Water Rheostats for Artificial Load

By Norman L. Rea*

The need of artificial load is felt sooner or later by every power-house operator. "Necessity is the mother of invention," so countless schemes have been tried by countless men. The great trouble is that the same mistakes are made over and over again. The writer has decided to set a good example to others by outlining briefly several schemes that have worked more or less satisfactorily.

The first step is a careful inventory of the local conditions, amount and kind of material available. Then the question of whether the equipment is for temporary use or a permanent fixture must be decided. Local conditions have a very great bearing in all cases, and equipment that works nicely on one job has failed utterly on the next.

For instance, most temporary high-voltage water rheostats are used in fresh water and an arrangement that gave excellent service in one stream was a total failure in another. Considerable worry and study finally solved the problem. The second stream was fed by salt springs and carried about 2 per cent. salt. Naturally there was no way of cleaning the water box, and the scheme was abandoned. Experience has divided these temporary water rheostats into two classes, high voltage and low voltage; 2300 volts and under require some kind of a tank as the water must be salted. The quantity of salt, of course, varies inversely with the voltage. If the rheostat must handle more than a few hundred kilowatts, it is better to step up the voltage, provided transformers are available. It is a heart-breaking experience to try to balance the load on several water barrels in multiple. First one and then another barrel heats up, grabs the load and boils over.

An Average Load

An average load of about 200 amp. can be handled continually on a barrel rheostat, and 400 amp. for a few minutes. Two or three barrels can be used in multiple without a great deal of trouble; four or more are unwieldy and hard to handle. The maximum tried by me on water-barrel rheostats is 500 or 600 volts, although 2300 volts might be handled satisfactorily.

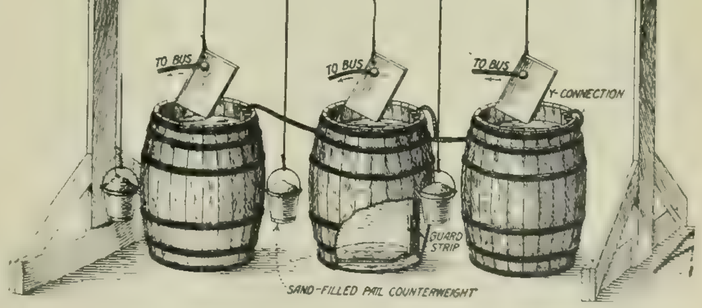
These barrel rheostats are made by putting a flat iron plate in the bottom of the barrel and bolting a wire to it. The wire is brought up the side of the barrel and covered by a wooden strip to prevent the movable plate swinging against it and short-circuiting. The upper, or movable, plate should be rectangular or triangular in shape and hung so that a corner will first enter the barrel.

The movable plate should be hung by ropes over pulleys and counterweights for ease of adjustment. Contact of the plates will, of course, cause short-circuits, which can be prevented in several ways. A lattice grating over the lower plate, a short length of rope tied securely to the plate and to some overhead support, or the counterweight attached to the rope to strike the first pulley have all served this purpose.

When used on single-phase or direct-current circuits, careful tests should be made for grounds and the stationary plates connected to the grounded side of the circuit. In three-phase circuits the barrels should be connected in Y, by tying all the bottom plates together. The figure shows a barrel rheostat for loading three-phase equipment.

Use Strain Insulator

A 600-volt strain insulator of some kind should be used in the operating rope. In any case the rheostat must be carefully fenced off to prevent accident. A hose or pipe should be arranged for supplying water during the tests. A little cold water will reduce materially the load on any barrel that is overheating. The rheostat should be installed, if possible, outside the building, as the steam and overflowing water make a nasty mess.



Water-barrel rheostat for three-phase load.

Above 2300 volts temporary rheostats are preferably installed in open water. This can be done in the forebay or tailrace of a hydraulic plant or the cooling pond of a steam station. The location should be chosen with due regard to the length of connection between the rheostat and the generator under test and to the proper safeguarding against accident.

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*Construction engineer, General Electric Co., in "Power."

If the tailrace is the best location, a hollow raft for the rheostat is usually necessary to prevent waves and also variations in tailrace level changing the load. A light scantling framework on this raft will support the insulators for the lines and the electrodes. Adjustment of load usually necessitates disconnecting the rheostat or opening the generator-field circuit.

Carbon rods, copper balls, copper bars, boiler plate, floor gratings and iron pipes have all seen use as electrodes. The boiler plate or iron pipes are as good as any of the others and are usually available. Electrodes can be hung from a rope and standard strain insulators, or on standard line insulators installed horizontally when the strain insulators are not available.

Surface Contact

The spacing of the electrodes or the distance between them apparently has little, if any, bearing on the carrying capacity. Evidently, surface contact is the determining factor, as given electrodes carry practically the same current whether spaced 5 or 50 ft. apart. This simplifies the construction of the three-phase rheostat, as the plates may be hung in any convenient grouping with the same result as a carefully spaced equilateral triangle. There is one peculiarity, however, that should be kept in mind. It may be necessary on large-capacity rheostats to use two or more pipes in multiple. These pipes will carry more current when separated several feet than when carried side by side.

The carrying capacity of an electrode is limited by arcing caused by gas or steam on the electrode surface. This gas or steam periodically blows the water away from the pipe, drawing a series of arcs. This causes violent fluctuations of the load, and satisfactory operation is impossible under these conditions. If electrodes are hung in running water, the gas will be swept away as formed, with a consequent increase in capacity. These electrodes should be kept well away from submerged timbers or charring and arcing may occur. The sight of a log burning under water usually creates wild excitement among the natives.

All adjacent metal parts of the building should be tied together with cables to prevent burning between the concrete and the iron and also to reduce the danger of electrical shock.

The rheostats usually kill and in some cases cook a large number of fish. When the plates are comparatively close together, a large fish apparently offers less resistance than the water and will carry enough current to burn to a crisp.

Variable Conditions

All the foregoing conclusions are based on experiments when time was at a premium and the cheapest temporary load was the object sought. Experience shows that there are so many unknown variables in any particular location that the cut-and-dry method is far and away the easiest and best.

The temperature of the water, the kind and amount of mineral salt in solution, or even the amount of mud in suspension, all affect the problem. An arrangement that has worked satisfactorily on 30,000 volts in several mountain streams has failed utterly when tried on 2300 volts in a stream carrying silt and mineral salts.

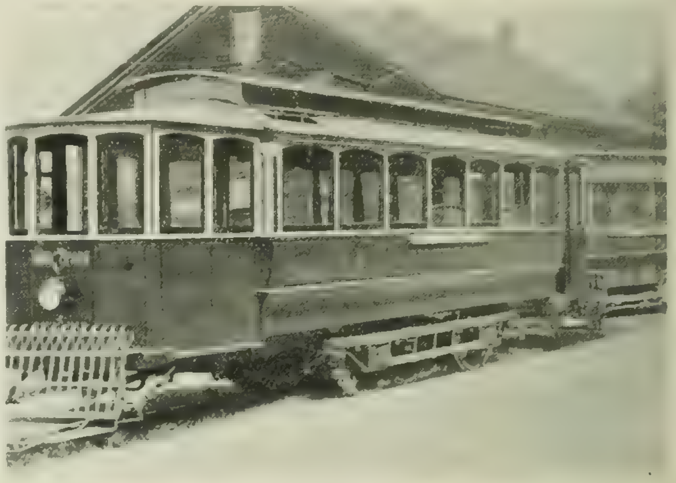
67 Cases of Fare Increases

The Bureau of Information of the American Electric Railway Asociation has prepared a list of electric railways which have obtained fare increases of some sort since the year 1914. In all 67 cases are noted, of which 4 belong to Canada, viz.: The Port Arthur and Fort William Electric Railway, the Saskatoon Municipal Railway, the British Columbia Electric Railway (this was a reduction to stimulate traffic and fight jitney competition and was discontinued), and the Kingston, Portsmouth, and Cataraqui Railway. For the most part the changes are from 6 tickets for 25c to a straight cash fare of 5c.

The latest increase noted is that of the Bay State Street Railway, of Boston, which has just been granted permission by the Massachusetts Public Service Commision to establish a 6-cent fare on its entire system for a six months' trial. The sale of 20 tickets for $1 and a universal transfer have also been approved.

Safety Car Used in Kitchener

The car illustrated herewith is that recently placed in operation by the Kitchener and Northern Railway Company, and described in the last issue of the Electrical News. It is operated by one man. As shown in the photograph, when the door is opened the step is automatically lowered and vice versa. This car has now been in operation since early in July and is giving satisfaction.



Kitchener safety car giving satisfaction.

Favorable Experience in Port Arthur

Another Canadian city that has had favorable experience with the "safety" car is Port Arthur, Ont. In that city the street railway is under the Public Utilities Commission, of which Mr. M. M. Inglis is manager. Mr. Inglis has had three one-man cars in operation on the Belt Lines for almost two years, and so far they have been eminently successful. These cars also take in a portion of the main line system. During the rush period they have experienced no great difficulty, owing to the fact that the one-man cars are more or less all loaded up at the terminal point.

They have been entirely free from accidents during this period, and the patrons of the system are more than satisfied since the inauguration of the one-man cars, owing to the fact that the management have been able to give them more frequent service than under the two-man car operation.

The greatest difficulty found in connection with the operation is in the matter of making change, where straight 5 cent fare is collected. Where tickets are used and the "pay as you enter" method of collection in operation, Mr. Inglis says he fails to see why one-man car operation should not prove successful and come more into use in the future. Mr. Inglis adds: "We could not do better than recommend one-man car operation on routes where traffic is not congested."

Refitting Steel Wheels with New Tires

Practice Followed by Big Coast Company Reduces Maintenance Costs—Illustrated Details of Equipment

The British Columbia Electric Railway Company some years ago inaugurated the practice of refitting their wheels with tires on both their city and interurban lines. The practice has met with success, and, in consequence, the illustrations herewith, which indicate in detail this company's practice, will be of interest to other Canadian electric railways. In these illustrations the standards are shown for both city and suburban wheels. On new equipments, the B. C. E. R. Co. place a rolled steel wheel having dimensions suitable for use, after they have run their mileage, as centres for tires. On their city equipment these tires are shrunk on with no other fastenings than a guiding flange on the front of the face, and the tire riveted over the edge of the wheel centre at the back. So far, the company have experienced no difficulty with these tires after wearing to a thickness of 1⅛-inch, but they do not consider it advisable, under the heavy braking conditions obtainable on their lines, to allow their tires to run with any less than a 1⅛-inch thickness.

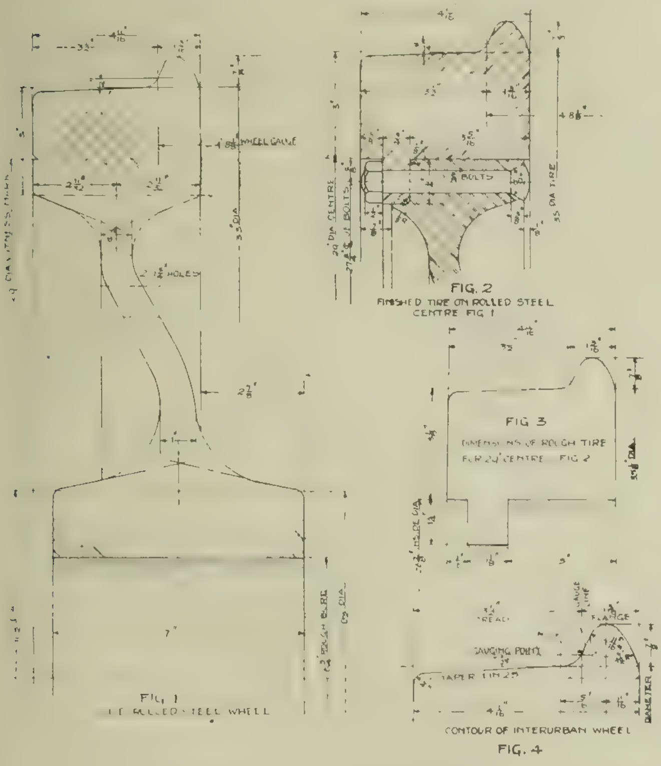
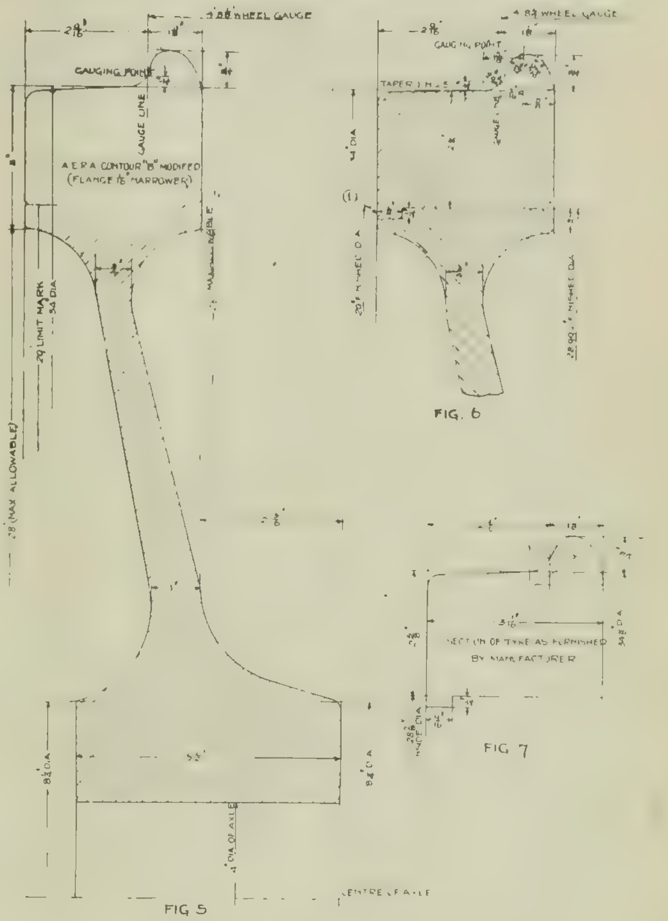


FIG. 1
ROLLED STEEL WHEEL
HOLES
WHEEL GAUGE
BOLTS
FIG. 2
FINISHED TIRE ON ROLLED STEEL CENTRE FIG 1
FIG 3
DIMENSIONS OF ROUGH TIRE FOR 24" CENTRE FIG 2
TREAD
FLANGE
GAUGING POINT
TAPER 1 IN 25
CONTOUR OF INTERURBAN WHEEL
FIG. 4

Interurban steel wheel and bolted tires.



Rolled steel wheel and tire for city traffic.

On their interurban equipment they start with a 33-inch wheel with a 3-inch rim, which, when worn to witness mark, is turned for a centre to which the tire is bolted in the same way as is used by the Midvale Steel Company, and which is rapidly becoming standard. These rolled steel centres are lighter than cast iron centres, the combined weight of centre and tire being very little more than an original wheel, or practically the same on the city wheels. Under the conditions obtaining in Vancouver as to distance from market, consequent difficulties in delivery, freight charges, etc., the B. C. E. R. Co. have found this combination of steel wheel and tire to be the most economical to date, although whether it will remain so, with the present condition of the steel market, is becoming problematical.

A study of the illustrations will indicate in detail the wheel practice of this company.

Toronto Conciliation Board Findings

As we go to press announcement is made by Judge Snider, chairman of the Conciliation Board appointed to determine the points at issue between the Toronto Street Railway Company and its employees, that it has not been possible to reach a unanimous agreement. It is intimated that the chairman and Mr. D. A. Carey, the appointee of the employees, will make a majority report. Mr. Duncan McDonald, the appointee of the company, may agree to this report after consultation with the manager, Mr. R. J. Fleming, or he may submit a minority report. It is intimated that all points at issue have been agreed upon with the exception of the wage rate, which, it is understood, is placed at 7 cents an hour increase in the majority report. The amount originally asked for was 10 cents, and the company granted a temporary increase of 6 cents pending the finding of the Conciliation Board.

Hydro current was recently turned on in Watford, Ont., supply being furnished from the Kent sub-station.

The Dealer and Contractor

Does Your Show Window Bring You Business? —Is it One of Your Sales Staff?—Utilize to the Utmost This Most Valuable Part of Your Store

"How to Make Your Show Window Pay Your Rent," another of the Society for Electrical Development's new series of "How to" service booklets, has been issued. This booklet takes up the question of efficiency in window decoration, giving a number of valuable illustrated suggestions as to what to do and what not to do to bring real results. It is by no means of the nature of a text book on the subject, but rather a brief hand book of simple facts for the guidance of salesmen, dealers and others, who may be led, after reading it, to the study of more pretentious works along similar lines. No book like it, however, has ever appeared in the industry, and electrical men who have never given serious attention to window display matters will find abundant reasons why they ought to do so. The booklet aims, first of all, at being practical, and its suggestions may be applied to small displays as well as to large ones. Following is a list of the chapter headings:—Half the Game is in Looking the Part; How to Secure Simplicity; How to Avoid Confusion; How to Avoid Reflections; How to Make Window Backgrounds; How to Finish off Your Background; How to Make Window Floors; How to Make Your Window Attractive at Night; How to Care for Equipment; How to Avoid Loss of Pulling Power; How to Utilize the Ideas Shown in the Sales Service; How to Utilize the Store Interior; How to Arrange Show Cards; How to Make Your Displays Timely.

Making Your Show Window Pay Dividends

There is one space in your store that is valuable above all others—Yes, ten times more valuable—Your Show Window. It is worth all the time, money, care and intelligent thought that you can put into it. The best window display is that which sells the most goods—not the one which shows the most or entails the greatest expense. It is the common sense window. You can't conceive of a better advertising medium or space in the whole merchandising world—pay what you will. Isn't it, then, well worth while to give careful, thoughtful study to those principles on which experts and authorities have developed window trimming to modern perfection?

It has been variously estimated that from 30 to 50 per cent. of store sales are, in fact, made on the sidewalk, through the medium of good window display, before the patron enters the store. Some claim even higher percentages. The fact remains that buying enthusiasm can be created through this valuable medium which fully justifies every effort toward making the display most presentable.

No merchandising line lends itself better to an attractive showing than electrical goods. The electrical dealer is, therefore, in an unusual position to put his window in the best class.

Half the Game is in Looking the Part

Do you ever stop to realize the many people who see nothing of your store but the outside—the front? Many of them are possible customers—some of them your present customers. You are courting favor from all of them. Is your store front—your show windows—neat and attractive so that you can afford to stake on it the entire reputation of your business? Does it reflect you—your policy? It should. It is one of your biggest advertising assets and can be made to bring you in a lot of new business if you will only give it the attention a wonderful opportunity deserves.

The secret of real success in window display, from the viewpoint of profit, is to develop the greatest possible pulling power at lowest cost. But when windows fall short of top notch selling efficiency, that store is losing money, for every lost sale is so much lost money.

With many electrical dealers the matter of displays has been neglected, while strenuous efforts in other ways have been made to attract trade. Many times business is attracted to the store, but the appearance of the windows, store front and goods on display fail to confirm or bear out the favorable impression the other publicity has made. So, Mr. and Mrs. Customer, when right at the door ready to buy, hesitate, reconsider, and naturally gravitate to the store of the dealer who has developed the possibilities of his windows.

An Appeal to the Eye is Effective

The sales capacity of a window is measured strictly by its attractiveness. When you fail to recognize that fact you are passing up your first and easiest way to get on the profit side of your ledger. An appeal to the eye is the most direct and effective method of arousing interest in merchandise. Practically every article must first appeal to the eye. The good window display owes its effectiveness to this first principle of selling.

Let Common Sense Help in Your Window Displays

There are some "set rules" which the experienced window dresser will follow, pertaining to deft workmanship and the artistic, but beyond and underlying all is that easiest yet rarest used faculty (which every one can cultivate)—common sense! And common sense says that a window should not be crowded full of many kinds of devices, or the same kinds of goods, in the belief that the more there is shown in the windows, the more there will be sold.

There is a consistent limit to the amount of merchandise that should be shown as to obtain the maximum results without confusion. More than that necessary to make the display distinctive and attractive will make it distractive, confusing and much less effective in results. The art in window trimming is largely a matter of knowing when and where to stop.

The display window of the past, with its miscellaneous collection of wares, has been discarded. The one of simplicity, good balance, and good lighting has taken its place. Nothing is more detrimental to a merchant's store front than an overdressed window display. Simplicity must be observed. The most effective window display is that which exhibits a single idea. It drives home a single thought which not only attracts quickly but is retained more easily—remembered. The spectator gets a single impression centered on the line displayed and when he passes on, the mental picture goes with him. A single impression is more easily made than a series of impressions.

How to Secure Simplicity

A single-idea display can be made more complete than is possible with a variety of goods. It is much easier to dress a window attractively with a single idea than with a miscellaneous display. Furthermore, with single-idea displays changes can be made more often with the contrast so strong that the mere change itself attracts attention.

All window displays should be changed often; they should never be allowed to get stale and to this the single-idea adopts itself admirably.

Miscellaneous display is admissible occasionally for the sake of variety and change. Variety display with some classes of goods is desirable, but that should be the exception rather than the rule.

Artistic Arrangement

The window display that is arranged on artistic lines will attract favorable attention. The appreciation of the masses of the fitness of things is much greater than is generally acknowledged. All people may not be critics but nearly everybody is subconsciously attracted to a display made with due regard for the artistic. The general public comprise an entire group of possible customers, but only the pleased element can be considered as probable purchasers. If the public receives favorable impressions from the show-windows it has been brought to a condition of mind that must always precede purchase. The display has secured its "good will" as well as attention; and this "good will" is the most important asset any concern can have. There is a natural harmony between the artistic and the practical. The public is pleased and the merchant is benefitted by the artistic, practical display. The fact that the purpose of the show window is to sell goods should not and need not be lost sight of in an attempt to create a pretty picure. The window story should always carry its selling "punch," the display being built around this idea.

Bring Out the Merits of the Articles

After selecting the goods for display, the next step is to so arrange them as to attract attention. By this is meant attention to the merits, the utility of the goods, rather than to the pretty manner in which they are arranged. The more the display man tries to bring out the good points of each article, and the less he tries to do something smart and pretty, the more successful he will be in making displays that really sell goods.

Merely attracting attention, however, is not enough. The window must be so arranged that the passer-by will stop and look. Interest must be still further aroused to the extent that this passer-by instinctively wants to learn more about the goods. Show cards are essential and must contain strong selling talks. The thoughts presented should be so forceful as to create in the mind of the reader a desire to possess the goods. A thoroughly successful display is arranged in such a manner as to first attract wide attention. It causes the largest possible numbers of those passing to stop and look over the display. It then causes the largest possible number to enter the store to make a purchase.

It is not always the size of the window or the display that draws the crowd. It is the novelty of arrangement or stock shown. A small window is often made to pull better than other larger ones.

Avoid Reflections

Some stores are so located that the reflections of light from the glass are so strong that at certain times of the day it is practically impossible to see the display at all.

There are windows where one cannot get a glimpse through or behind that glaring reflection, even by getting close to the glass and twisting the head this way and that. The cause of this is the superabundance of light on the outside—the side of the glass on which the observer stands. The trouble increases with the brilliancy of the outside light and the darkness of the display or trim inside. With a bright day and a solid black window trim, a plate glass makes an almost perfect mirror. The reverse would be a perfectly white interior, in which case the glass would be almost invisible and the reflection much less or not at all. This is borne out by the fact that at night-time there is little or no reflection; windows usually appear to have no glass in them.

The remedy is obvious: have as light an interior and background as possible—tints and shades instead of strong, solid and dark colors. Where of necessity the display or trim is black or dark, the reflection can be greatly lessened by turning on the (inside) window lights. All this is self-suggestive of keeping the windows spotlessly clean.

Electrical Week for Winnipeg, September 3-8

Winnipeg is having an electrical week beginning Monday, September 3, and continuing until Saturday night, September 8. This will take the form of a display and demonstration of electrical goods and equipment at the Alhambra, the reconstructed coliseum on Fort Street. Mr. J. M. Leamey is chairman of the exhibition board. All the booths have been disposed of to prominent electrical firms in the city, and the decorations and installations of equipment are proceeding. The idea back of the undertaking is not to make money but to place before the public an opportunity of observing the great advances that have taken place in electrical equipment for the home, the factory and the office, and to demonstrate their labor-saving and pleasure-giving qualities. Entrance to the display has been placed at the nominal rate of 10 cents, which is to be donated to the Patriotic Fund and the Red Cross.

It is fitting that an electrical display of this nature should be held in Winnipeg, which is one of the Canadian cities which boasts of exceedingly cheap power, so that the various electric utensils now so commonly used may be operated at a nominal cost. For example, Winnipeg already can probably claim a larger percentage of homes using electricity for cooking than may be found anywhere else in Canada and the present display and exhibition should add very considerably to this number. A feature of the week will be a midday luncheon prepared electrically. Electrically prepared meals will also be served at any hour to visitors who may order.

Mr. Knott's Canadian Trip

Mr. George C. Knott, Hatheway & Knott, electrical merchandise, 120 Liberty St., New York, has, during the past two months very thoroughly covered the Dominion of Canada in his firm's interests. In addition to carrying off some nice orders, Mr. Knott also carried away the pleasant recollection of many old friendships renewed. If he will only make this trip often enough Mr. Knott may soon be a good Canadian again. Hatheway & Knott designate themselves "New York headquarters for the Canadian electrical trade."

New Book About the Society for Electrical Development

The all the year round activities of the Society for Electrical Development are pictured and described in "Aims and Achievements," a review of the Society's work which has just been issued. The book is a concise readable digest of what the Society is doing. It describes in terse, simple language its endeavors to combine engineering, publicity, merchandising, advertising and field co-operation for the benefit of its membership and the entire industry. A graphic chart, which is a feature of the book, separates this work into three divisions—educational work with the public; investigation and educational work with other trades and industries; and trade development and sales promotion work with the electrical industry itself. In each of these fields the Society is doing certain definite, important work, along lines not duplicated by any other organization. The new book is entirely without any spirit of boastfulness, assuming rather a modest, straightforward style which is convincing. It is a sincere presentation of the reasons for the Society's existence, giving a clean insight into the constructive work it is doing for its members and the entire electrical industry. Upon request, a copy will be sent free to anyone interested.

George Cutter Company Changes

George Cutter Company, South Bend, Ind., announces the appointment of R. W. Ten Broeck and A. B. Sonneborn as sales representatives for the state of Michigan. They have established offices at 426 Ford Building, Detroit, Mich. In connection with the sale of street and industrial lighting equipment, switches, panel boards, switchboards, cutout boxes, and other products of the George Cutter Company, an engineering department will be maintained for the purpose of drawing up plans and specifications for the installation of such equipment. Both Mr. Ten Broeck and Mr. Sonneborn are well and favorably known to the electrical trade, especially in the Detroit territory. The former was associated with the Packard Motor Company for a number of years, later with the Davis Slate & Manufacturing Company, and for the past two years with the Mutual Electric & Machine Company of Detroit. Mr. Sonneborn was connected with the latter company for three years and during the past year was district representative of the Detroit Electric Welder Company, of Lansing, Mich., with offices in Detroit.

Using Bonus to Cut Costs

In Sedalia, Mo., the City Light and Traction Company, owned by the Cities Service Company, is combating the high cost of labor and materials by offering a bonus to the employees of the Broadway electric plant for reducing the fuel consumption below a certain figure. This figure, at which no bonus is paid, is set at six and one-half pounds of coal per kilowatt-hour, and when the coal consumption is reduced below this standard amount, the employees receive 25 per cent. of the cost of the coal actually saved. The savings are posted each day, and the plan is developing no small amount of interest among the employees. The bonus is divided equally among all of the men, and for the month of April was $3.92 per man. Mr. F. A. Clark, chief engineer, is sure that the bonus will soon amount to a considerably higher figure.—N.E.L.A. Bulletin.

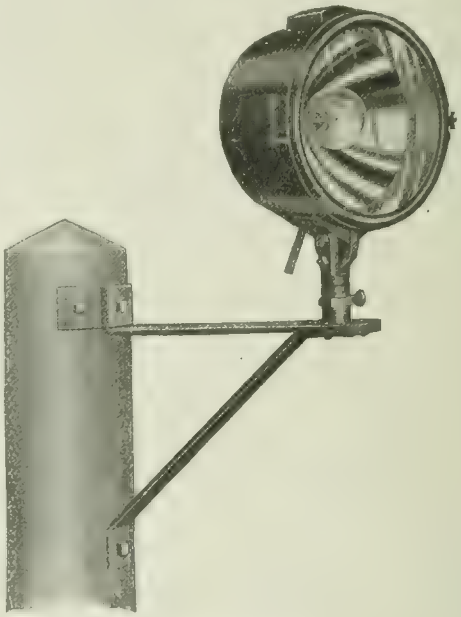
This Sold Lots of Goods

With a busy young man at a desk inside to talk with anyone who might use it, an eastern electrical shop installed a telephone just outside the display window. The novelty of the idea appealed to passers-by, and hundreds grasped the opportunity to speak to him through the instrument. System.

"Golden Glow" Flood Lighting Projectors

"Golden Glow" headlights for steam and electric railway service, and "Golden Glow" and "Crystal" mirror search lights for marine and other purposes are so generally known that the announcement that the Electric Service Supplies Company have recently enlarged their line to embrace flood lighting projectors will be received with a great deal of interest. The new line of flood lighting projectors shows types for various purposes. They embody the use of a 14-inch glass mirror, either of "Golden Glow" or "Crystal" glass, the particular type suited for any given condition depending largely as to the functioning of the eye under the given condition. These mirrors are true paraboloids; they are first pressed to shape in moulds, the inside then being polished by a special patented process; the outside or back surface is then ground to a mathematically exact curve and later polished. After this it is given a heavy backing of silver, which in turn is copper-plated, and the copper finally coated with a compound to make it impervious to moisture, gas, or other agents. Both "Golden Glow" and "Crystal" mirrors are highly perfect optically and on this account are highly efficient as light projectors.

The only difference between "Crystal" and "Golden Glow" mirrors is in the quality of the glass employed, the former being of clear crystal glass, while the latter is greenish-yellow in color, better known perhaps simply as "Golden Glow." The projected light from a "Crystal" mirror projector is white, much the same in special qualities as the light from the incandescent bulb employed. "Golden Glow" projectors project a flood of soft golden-yellow light, this due to the fact that the mirror alters the spectral quality of the light received from the incandescent bulb before projecting it into the beam. This alteration of the spectral qualities of the light is accomplished while it is passing through the "Golden Glow" glass to reach the silver reflecting surface of the mirror; in this passage, the light from the bulb has subtracted from it a large percentage of the high frequency rays—that is, rays above the green portion of the spectrum; in other words, the glass absorbs these rays and passes and reflects the rays of all portions of the spectrum below the blue. Owing to the fluorescent nature of the glass, a large percentage of the absorbed radiation is returned to the projected beam in the form of greenish-yellow light—the light of highest visual characteristics. The projected light

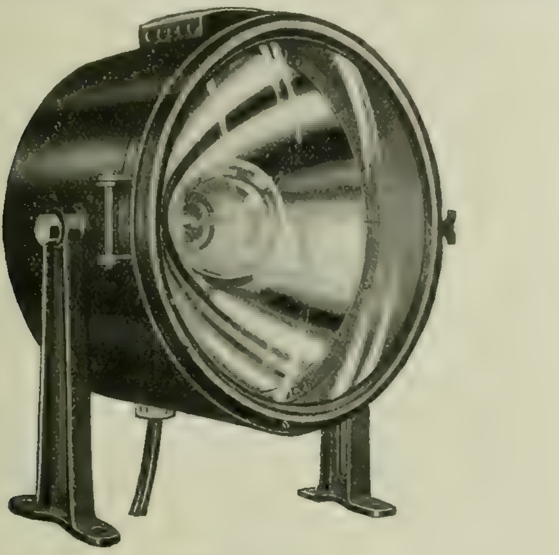


Type FL-1412 equipped with type B support.

is therefore rich in the soft, non-blinding, greenish-yellow rays of the spectrum.

The light from the "Crystal" mirror projector being white and spectacular, should be used on all flood lighting jobs where spectacular results are desired. As for example, in flood lighting monuments, public buildings, flags, fountains, etc. White light can and should preferably be used on all flood lighting subjects where lighting the subject as a whole is the main consideration. It should not be used on subjects requiring the disclosure of very fine detail or on subjects where the eye is to be called into continuous use.

The light from "Golden Glow" projectors is a soft, golden-yellow light, a light rich in rays under which the eye works at its highest efficiency. Therefore, this light should be used in flood lighting all utilitarian subjects; it should be used for all subjects in which the eye must be able to disclose fine detail, or where the eye is to be called into continuous use. These two simple rules make easy the selection of the proper projector for each and every occasion. In their general flood lighting catalog, the company publish a list of some 125 subjects suitable for flood lighting.


Type HBD-1412 reflector.

Both the 14-inch mirror projectors are adapted to take a 400 watt Mazda C concentrated filament flood lighting bulb; by the use of an adapter any medium screw base lamp may be employed—such as the 200 watt Mazda C flood lighting lamp, or any other standard concentrated filament lamps designed for headlight or stereoptican service; with this wide range of lamps to select from, it is readily seen to what a wide variety of uses these projectors may be placed. Equipped with a 400 watt flood lighting bulb, these projectors give a maximum beam candle power of over 250,000, with a beam dispersion of 12 degrees; by drawing the filament of the bulb slightly behind the focal point of the reflector the dispersion may be increased to 16 degrees, the candle power decreasing to approximately 140,000; controlling the dispersion in this manner enables the beam to be most effectively controlled for any particular purpose. For general purposes the company recommend their Type FL-1412 projector, with either reflector, depending on the flood lighting conditions to be met. As this projector is fundamentally the basis on which all the types are built a brief description may be given regarding it.

The body proper, including ventilator housing and door, is made of sheet metal; wherever possible electrical spot welding is utilized instead of riveting, this resulting in a strong, rigid and weatherproof construction. The door is swung on heavy pressed steel hinges, is fitted with a rubber basket to assure its being thoroughly watertight, and is held securely closed by a wing nut latch which will not work open. The mirror is supported in a steel felt-lined shell and is securely held therein by means of eight segments clamping the edge throughout the entire periphery. This steel shell also supports the entire focusing mechanism as well as the incandescent lamp, so relieving the mirror of all strain. The projector is amply ventilated, cold air entering same through openings in the lower portion of the door; this circulates around the lamp and mirror, portions passing behind the mirror through openings in the upper retaining segment, while still other portions pass into the mirror and around the lamp base where, passing backwards through the mirror opening, they cool the base of the lamp and all mechanism having to do with its support and focusing. All heated air passes out through the ventilator located on top of the housing. This system of ventilation has proven almost ideal, keeping the lamp, mirror and mechanism at a reasonable temperature at all times. To the lamp casing proper is mounted a heavy cast quadrant, this being supported in a double-jawed swivelling base; by means of this construction the lamp may be rotated in any direction or elevated or depressed at will, thus enabling the operator to accurately train the beam on any object to be illuminated; means are provided for locking the lamp in any desired position.

Automatic Pole-Type Constant Current Transformer

An automatic pole-type constant-current transformer for use with series street lighting systems at points distant from the central stations has been perfected by the Canadian General Electric Company. The theory of operation is identical with that for station type, constant-current transformers. The unique feature of this type is that it is mounted on a pole and is operated by an oil time-switch. There are no new and untried principles or parts. It is a consolidation of various features previously tried and proved right in other types of transformers which have been on the market for a long time. It is entirely automatic in operation, is submerged in oil, mounted in a weather-proof tank, and requires no care or attention after it has been properly installed. It may be properly referred to as an "outdoor" transformer. For indoor use it may be mounted on the station wall or ceiling, if floor space is at a premium.

This type R. O. transformer fits into the lighting companies' systems where transmision conditions arise which would require a sub-station with control panels and attendants, but where the amount of business obtainable and construction costs make such an installation impracticable. Series street lighting systems require constant current and constant current transformers have always required a sub-station with control panels and an attendant. On that account it has been difficult to provide street lighting for smaller towns and villages where the revenue derived would not be sufficient to warrant such an installation. Larger cities also have experienced difficulty in solving the demand for higher intensities and more units in their suburbs. The growth of these outlying districts has been so rapid that it has been almost impossible for the facilities of the lighting companies to keep pace. When it becomes impracticable to run circuits from the central station, on account of the distance and the copper required, it is not always advisable to erect a sub-station. In many cases the growth of communities is so rapid that there is an interval before the sub-station can be erected during which the lighting service is hard put to be efficient and effectual. The type R. O. transformer was designed for this service and to fill this demand. It does not require a sub-station or an attendant, and can be controlled by an oil time-switch. These transformers also possess current regulation as close and through as wide a range as is given by the best station type CC transformer. The current from full load to no load is maintained within 1 per cent. of normal. This feature alone materially prolongs the life of Mazda lamps operating on a circuit controlled by such a transformer. The efficiency is the same as for the station type transformer, and has a high power factor.

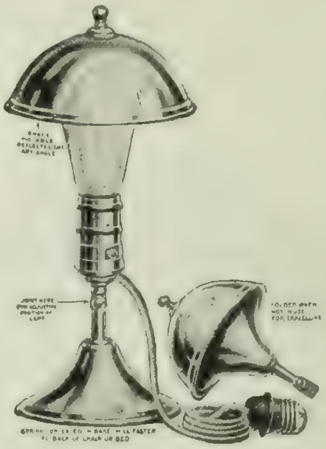
For the operation of Mazda C lamps this transformer has material advantages. The high initial reactance serves to protect the lamps at starting, and acts instantaneously to check surges on the line which would shorten lamp life. The moving secondary coil, with its high repulsion, gives almost perfect regulation from full load to dead short circuit. It not merely protects the lamps from changes in current due to changes in secondary load, but it also protects the lamp from fluctuations in primary voltage.

The theory of operation being identical with that for the station type constant current transformer, the design differs only in the requirements to make the transformer automatic. Instantaneous and entirely automatic regulation causes constant current within 1 per cent. on either side of normal to be maintained from full load to short circuit. No adjustments or changes in taps are necessary. A tap is provided in the 2,300-volt primary so that the transformer will carry full load and regulate satisfactorily when operated on a 2,000-volt circuit. In addition, the 2,300-volt transformer is designed so liberally that it will give good regulation on a 2,400-volt circuit. These transformers have an ultimate temperature rise by resistance not exceeding 55 degrees C., based on a surrounding temperature of 25 degrees C.

The Society for Electrical Development are distributing a bulletin describing the use of the electric fan in drying fruits and vegetables. The United States Department of Agriculture recently published Bulletin 841, describing how various vegetables and fruits may be preserved by drying the water out of them and recommending the electric fan as the most convenient instrument for this purpose. The bulletin issued by the Society gives a quantity of useful information on this new industry.

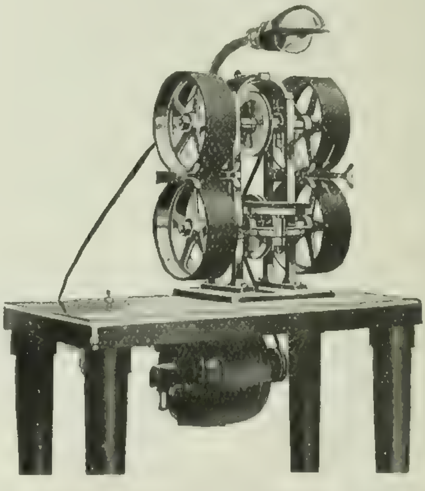
Portable and Adjustable Lamps

In the illustration herewith is pictured the Wallace portable and adjustable lamp—the lamp that "stays put" anywhere; that is, it clamps, stands or hangs anywhere and folds compactly into a small space for travelling. Note the adjusting joint for regulating the position of the lamp. In addition there is also furnished a two-arm extension bracket so that current for lighting and for some other purpose may be used at the same time. When so used, the lamp is an attractive table lamp and for this purpose is supplied with silk or cretonne shades. For fastening to the back of a chair or to a bed, etc., there is a spring concealed in the base. The lamp is manufactured by A. C. Penn, Inc., New York city, and is being distributed in Canada by Menzies & Company, Limited, 439 King St. West, Toronto.



Electrically Operated Razor Blade Sharpener

The razor blade sharpener made by the A. E. Hill Mfg. Co., Atlanta, Ga., sharpens the blade on the same principle that has always been used in sharpening the old style razor by hand. The only difference is that with this machine the hone and strops are rotated instead of moving the razor over them. The hone is in the form of a flat disc which rotates in a horizontal plane and the strops are mounted on wheels which run in vertical planes. A special folder is provided for the blades which will hold every style of blade. To sharpen the blade it is placed in the holder and held against the rotating hone for an instant, each side being applied to the hone. The holder is then inserted in a slot provided for it between the two sharpening wheels and rocked up and down so as to apply first one side of the blade to the bottom wheel, then the other side to the upper wheel. The same



operation is then performed with the finishing wheels. The sharpening wheels are made of coarse grained leather, the perforations being filled with a honing compound which feeds out over the straps and keeps them in condition. The finishing wheels are covered with the finest grade of horse hide which has been "broke-in" on a special machine. The construction of the machine and holder is such that it is impossible to apply the blades to the hone or strops at anything except the correct sharpening angle. It is claimed that any boy or girl can operate it and get the same results as an expert. A lamp bracket is mounted on the head of the machine so as to throw a good light directly upon the work. The stropping wheels and hone are belt driven from a 1/10 horse-power Robbins & Myers motor.

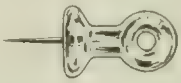
Portable Motor-Driven Planer

The small motor-driven planer, illustrated herewith, is manufactured by J. D. Wallace and Company. It is operated by a ¼ h.p. motor which can be connected to an ordinary light socket and is intended for use in pattern shops, repair shops and other places where small pieces are required to be dressed. The planer is equipped with two or three-knife cutter heads, the former operating at 4,000 r.p.m. and the latter at 3,600 r.p.m. The width of the cutting knives is 4 inches, the length of the front table 10 inches and the length of the rear table 8 inches. The motor is direct connected and may be used on either a.c. or d.c. circuit. Patented safety guards are provided which automatically expose and cover the cutting knives when stock is passed over and removed.

The G. N. W. Telegraph Company, Toronto, have on their operating staff two deaf and dumb girls successfully handling automatic instruments.

Glass Eyelets for Temporary Wiring

Glass push pins provided with an eyelet for use in temporary low-voltage wiring are being made by the Moore Push Pin Company. The pins are easily attached to woodwork or walls, and it is pointed out by the maker that they are particularly useful for amateur battery work where small wires are to be run about the house.



Trade Publications

Motor Generator Sets—Bulletin No. 181, issued by the Crocker-Wheeler Company, illustrating and describing motor generator sets for all purposes.

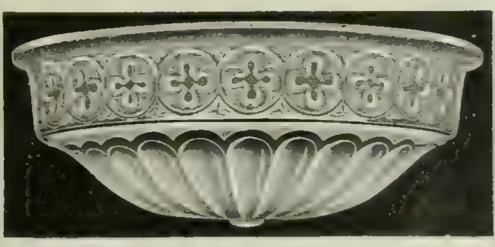
C. G. E. Publications—Bulletin 46251-B, Outdoor Metering Outfits; bulletin 44417-A, Ventilated Commutating Pole Railway Motor; bulletin 45600-A, Vacuum Tube Lightning Arresters.

Solderless Connectors—Catalogue No. 15, issued by Dossert and Company, New York, describing Dossert solderless connectors for stranded and solid wires, rods and tubing; also contains price lists, code words, dimensions and other useful information.

Motors—Bulletin No 24, issued by the Century Electric Company, St. Louis. This is a very completely illustrated and descriptive book of 64 pages on Century single-phase, self-starting motors of from 1/10 to 40 h.p. It contains many examples of motors applied to various appliances and data concerning their use.

Synchronous Motors for Power Factor Correction.—The Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa., has recently issued an enlarged and up-to-date circular on the theory and application of synchronous motors and power factor correction. The publication furnishes a clear and concise explanation of the underlying principles of power factor correction and its control. A complete set of accurately platted curves, accompanied by examples showing their application to cases in actual practice, are shown. These curves give the operating man and those unversed in technical calculation, a simple, graphical solution for all problems in power factor correction likely to arise in ordinary practice. Illustrations and detail descriptions show standard Westinghouse machines for capacities from 200 kv.a. to 15,000 kv.a. and for all commercial voltages from 220 to 6600 volts. Exact operating figures, furnished in several cases by members of operating staffs of the companies concerned, show the success of synchronous motors in improving operating conditions.

Harry Dallyn, an engineer on the staff of the Ontario Hydro-electric Power Commission, was recently electrocuted at Sarnia, Ont., while examining a switchboard. He was a graduate of Queen's University.



Illustrations of Gillinder bowls carried in stock by the Canada Sales Co., Church St., Toronto.

Current News and Notes

Cookstown, Ont.

Hydro-electric by-law recently submitted in Cookstown carried by big majority, only one vote being cast against.

Drummondville, Que.

In connection with the extensions which the Southern Canada Power Company are carrying out at Drummondville, P.Q., a contract has been awarded to the S. Morgan Smith Company, York, Pa., for a 400 h.p. single vertical turbine.

Minden, Ont.

Negotiations are in progress regarding the construction of the Minden Electric Railway through the Norland district. A preliminary survey has been made through Minden to Mountain Lake and estimates are being prepared as to cost.

Niagara Falls, Ont.

Reprisals against Canada are being talked of by merchants and business men in Niagara Falls, N.Y., because of the cutting off of the electrical power supply, due to the shortage in Canada. The purchase of the Ontario Power Company by the Hydro has the effect of depriving some United States concerns of power previously supplied by the Ontario Power Company. These manufacturers claim they have lost a hundred thousand horsepower by the deal, and they suggest that as a reprisal the United States be asked to put an embargo on all coal coming into Canada.

Though handicapped to some extent by shortage of labor the Chippewa development scheme is proceeding in good shape. It is noticeable in this large work that electric current is being used to a much greater extent than ever on a project of this kind. The trains which haul earth from the canal excavation are operated with electric locomotives and the shovels are also electrically operated. There will be no stoppage on the work this winter unless conditions are unusually severe, and it is estimated that five years will be required to finish the job.

Rosthern, Sask.

Tenders are called to September 1 by the town of Rosthern, Sask., for the supply and installation of a gas engine driven generator of a capacity of 50 kw., or, as an alternative, two units totalling this capacity. Transformer, switchboard and switchboard equipment and distribution system are to be included in the tender or submitted separately. The total expenditure is calculated at $30,000.

Thessalon, Ont.

The Hydro-electric Power Commission of Ontario are investigating the possibilities of power development in the vicinity of Thessalon, Ont. The sites examined included Halcombe's Mill, Little Rapids, McCreight Dam, Tunnel Bridge, Grand Falls, Slate Falls, Day Milles, Milltown and Ansonia. An ample supply of power, it is anticipated, would bring to Thessalon many new industries.

Vancouver, B.C.

The United Water Power Companies, Limited, has been incorporated; head office Vancouver, capital $32,000.

Personals

Major R. F. Morkill, former signal engineer of the Grand Trunk Railway, has been appointed by the Director General of Transportation to take over all signalling work in the area occupied in France and Belgium by the British forces.

Mr. C. J. Defbailletf, Montreal has been appointed manager and engineer of public utilities, including the light department, of the city of Sherbrooke, and will take up his duties on September 1st. The city has in contemplation a large amount of electrical work, including the building of a transmission line from Weedon, the erection of a substation and the installation of a new plant. Mr. Defbailletf is succeeded by Mr. E. O. Brown as electrical engineer of the Canadian Westinghouse Company, Montreal division.

Mr. F. P. Holliday has just recently received another promotion, this time from a Flight-lieutenancy to a Captaincy in the R. F. C. Some time ago he won the Military Cross and more recently also the D.S.O. Canadian friends will remember Capt. Holliday as unusually quiet and unassuming, but he has demonstrated beyond a doubt that beneath the surface there is plenty of that "sterner stuff" for which the British soldier is no less famed in the present than in former wars. As our informant puts it, "he has jumped right into the foremost rank of England's flying men." It is indeed gratifying to Capt. Holliday's friends that from a sapper in the Second Field Company of Canadian Engineers, which left Toronto in the early days of the war under Capt. (now Lieutenant-Colonel) T. C. Irving, he should have achieved so much honor and distinction. In this connection it is interesting to record an item in a British paper of July 13 to the effect that a daughter had been born to Capt. and Mrs. Holliday at their English home, 86 St. Helen's Road, Hastings.

We Offer For Sale
the following
SECOND HAND 60 CYCLE MOTORS
1 – 20 H.P., 850 R.P.M., 220 V., 2 Phase Westinghouse, CCL
3 – 10 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2 – 5 H.P., 1120 R.P.M., 220 V., 2 Phase Westinghouse, CCL
2 – 5 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1 – 2 H.P., 1720 R.P.M., 220 V., 2 Phase Westinghouse, CCL
1 – 2 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Crocker Wheeler, to be wound.
3 – 1 H.P., 1720 R.P.M., any volt, 2 or 3 phase, Westinghouse CCL, to be wound
2 -10 H.P., 1120 R.P.M., any volt, 3 phase, Westinghouse CCL, with Star Delta Switch.
1 – 20 H.P., 850 R.P.M., 220 V., 3 Phase Westinghouse, CCL
2 –10 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1 – 5 H.P., 1120 R.P.M., 220 V., 3 Phase Westinghouse, CCL
1 – 5 H.P., 1720 R.P.M., 220 V., 3 Phase Westinghouse CCL, rewound
1 – 3 H.P. 1720 R.P.M., 220 V., 3 Phase Westinghouse C, rewound.
1 – 5 H.P. 1720 R.P.M., 220 V., 3 Phase Westinghouse, C
25 CYCLE MOTORS
1 – 50 H.P., 750 R.P.M., 550 V., 3 Phase Can. Gen. Elec. Form K,
1 – 60 H.P., 750 R.P.M., 550 V., 3 Phase, Crocker Wheeler
TRANSFORMERS
2 – 75 K.W., C.G.E., H.G., 60 cycles, voltage 1040 2080 115 230
1 – 40 K.W., Packard R10 60 cycles, voltage 2200 220,
1 – 40 K.W., Westinghouse C, 60 cycles, voltage 2200 1100 220 110
1 – 2 K.W., Packard R10 60 cycles, voltage 1100 2200 110 220
Write for prices on these or new machinery.
Toronto & Hamilton Electric Co.
99-103 McNab N., HAMILTON Limited

Electrical News
Generation, Transmission and Application of Electricity

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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

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Vol. 26 **Toronto, September 15, 1917** **No. 18**

More Electric Companies Inaugurate Profit Sharing Plans

One of the many companies in the United States which have adopted the profit sharing plan in one form or another for their employees, is Henry L. Doherty & Company, operators of Cities' Service Company. This plan went into operation on August 1 of this year. By the rules now formulated for the carrying out of this scheme, any member of the Doherty organization may subscribe for the company's stock, the maximum amount of his subscription depending on the length of his employment and the amount of his salary. Employees of less than one year's standing may subscribe for an amount of stock equal to 50 per cent. of their yearly income; employees of three years may invest up to 80 per cent. of their income, and so on. Certain further limitations are placed upon the amount so that those with the biggest salaries may not purchase too much of the stock, which has been found a very attractive investment. The company's stock is divided into preferred and common in the ratio of two to one, and any money invested by an employee is used to purchase the two kinds of stock in this proportion; that is, if an employee invests $300, $200 of it buys preferred stock and $100, common stock. One of the most important features in connection with this scheme is that stock may be paid for on the instalment plan. Interest at the rate of 6 per cent. is charged on deferred payments on common stock, but the subscriber receives preferred stock each month according to the amount paid. No common stock, however, is delivered until practically paid for. In cases of emergency an effort will be made to carry the employee until such time as he can assume his obligations. In the event of an employee leaving the company, he may make special arrangements with them to continue paying his instalments, or the company will buy back the stock at the purchase price.

Effective Conscription Depends Upon Proper Classification

It is common knowledge that the sum total of the effective effort of our Canadian army has, in the past, been materially lessened owing to the apparent lack of appreciation on the part of the military authorities that the training and experience of certain classes of our recruits fit them for special work. This has been particularly and, we believe, glaringly obvious with regard to technically-trained men, for on the one hand we have many such enlisted as privates in the ordinary infantry regiments and quite unable to obtain transfers, while at the same time our engineer officers have been scouring the country for suitable men for their battalions, and finally, having failed to secure them, have been forced to accept unsuitable substitutes. The condition throughout, in a word, is one of "misfits," and the incomprehensible thing about the whole business is that such a state of affairs should exist when it is so obvious and when the remedy could be so easily applied.

What would be thought of any organization in civil life that, having a number of positions to fill requiring varying degrees of skill and ability would employ the required number from the first that offered and distribute them over the work with an utter disregard for their fitness? What degree of efficiency could such an organization expect from its staff? Yet that is very like the methods adopted in the past in the selection of our battalions, so far as technical men at least are concerned.

Now that conscription is in force and the government has been granted the right to say to each citizen of Canada "Come"—and he cometh—surely there is no longer any excuse for placing the engineer otherwise than where his training, experience, and inclination will make him of the greatest service to the Empire. There is little doubt, we trust, that our government will use the greatest care and wisdom in this direction. In so doing they will have the undivided support of all classes, many of whom have chafed at their inability to help terminate the war. As an example of engineering sentiment we may note a resolution recently passed by the Joint Committee of Technical Organizations (Ontario branch), and which we reproduce hereunder. It recites briefly the weakness in selection in the past, and urges that men be used for work for which they are most nearly fitted. This resolution, we understand, has already been forwarded to the Minister of Militia, Sir Edward Kemp. We believe it will appeal to every Canadian citizen, of whatever rank or position in life, as entirely reasonable and businesslike, and calculated to make for the greatest efficiency in our army.

"In view of the many instances coming to the attention of technical men of Canada where men technically trained have in the past been listed in or transferred into branches of the service for which, by training and experience, they were poorly qualified, thereby causing dissatisfaction among the men and reducing the efficiency of the service, and in view of the passage of the Military Service Act in the Dominion Houses of Parliament and the assurance that conscription will be put into operation at an early date, be it

"Resolved, that the Joint Committee of Technical Organizations make suitable representations to the Prime Minister and the Cabinet at Ottawa and others in authority, requesting

(a) That very special effort be made to insure that men e drafted into that branch of the service for which they are most nearly fitted by their training and experience in civil life;

(b) That the Joint Committee of Technical Organizations hereby express their willingness to assist the government to the best of their ability in carrying out the foregoing in the case of those branches of engineering—mining, chemical, or other industry—coming within their scope."

What is the True Value of Advertising?

An interesting story is told of the discussion at a board meeting of one of our large manufacturing companies recently, on the question of advertising. The active heads of the business were grouped around the big mahogany table debating ways and means, and the treasurer, watchful, as is his duty, of inroads on the treasury, was speaking: "I am strong for advertising at the right time. I readily admit that it will build up sales to a point that can be reached by no other means. I am the last one in the world to underestimate its value. But at the present moment it is absolutely impossible to fill any more orders than we have on hand—enough to keep us full steam ahead for many months. What can we possibly get out of an investment of thousands of dollars if we cannot meet the demand after we have created it?"

The advertising manager saw visions of a man without a job, yet he felt instinctively that any defence he may make would be discounted owing to the position he held. The situation was saved by one of the vice-presidents, who in past years had learned the real worth of advertising. "Gentlemen," he said, "there is a whole lot of truth in what our treasurer has just told you. We are tremendously handicapped by the shortage of raw materials and the present congestion on the railroads. As has been pointed out, we now have on hand enough business to keep us busy for a year. On the surface, it does seem like a waste of money to advertise now.

"But let us go deeper into this question. Just imagine that the war is over and there is no longer the condition of high prices and enormous demand that prevails now. Just imagine for a moment that foreign competition has once more broken into the field.

"Suppose we have discontinued our advertising; then, gentlemen, the condition which I have described will surely be a difficult one for us; and that is putting it mildly. Because of our short-sightedness the public will have forgotten us. The name of our product will no longer be a byword. It is very likely that a competitor will have usurped our place, simply by advertising when we think it unnecessary. I cannot urge too strongly that you consider this angle of the question, too.

"I feel sure—I was never so sure of anything—that the future of this great organization that we have so carefully nurtured and reared, is to a very large measure dependent upon the advertising we do now. By keeping our name and the name of our product before the public now, we'll hollow for our products a niche in the future.

"I know that every one of you carries a large life insurance policy. You think any man short-sighted who does not. **If some one were to suggest to you that you discontinue your policy, merely because you are well and physically fit now, and because the expense seems unnecessary, you would think your adviser was crazy.**

"But, gentlemen, advertising is the life insurance policy of this business. The premium is large. It hurts us sometimes to pay out thousands of dollars without seeming to get a tangible return on the investment. But just as sure as you're a foot high, the time will come when you will be glad that you were far-sighted enough to see what the future would bring."

Montreal Tramways had Good Year

The annual report of the Montreal Tramways Company for the fiscal year ended June 30, 1917, shows gross earnings of $7,725,500, as compared with $6,443,300 for the previous year—an increase of 14.45 per cent. The operating expenses, however, have increased at a greater rate, or by 24.14 per cent. The ratio of operating expenses to passenger earnings was 62.4 per cent., compared with 57.53 last year. The report states that the company has continued the work of placing its overhead feeder wires in the municipal conduit and has completed during the year the work commenced last year on Bleury Street and Park Avenue. The installation of the 17,000 h.p. steam unit is practically completed and was expected to be in operation by the first of September; work has commenced on the installation of another unit of the same size. During the year the company placed an order for 100 motor and trailer cars of the latest type and containing every known device and improvement to assure the comfort and safety of the travelling public.

At the last session of the Legislature the government appointed a commission of five members with power to make a new contract between the city of Montreal and the company. The directors expect this matter will be settled shortly and will result in the company being able to develop and maintain its system in the best interests alike of the public and the company.

The assets of the company are placed at $42,260,000, of which the cost of the road and equipment is $37,543,000.

Mineral Production of Canada in 1916

The Department of Mines, Ottawa, has just issued a preliminary report on the mineral production of Canada during the calendar year 1916. Of particular interest to the electrical trade is the reduction in the price of copper, regarding which we extract the following items. The average price of copper per pound in New York is given at 12.4 cents in 1911, 16.14 in 1912, 15.3 in 1913, 13.6 in 1914, 17.3 in 1915 and 27.2 in 1916.

The production of copper has shown large increases during the past three years. In 1916 the total copper contents of smelter products credited to Canadian ores and estimated recoveries from ores exported amounted to 119,770,814 pounds, which would be worth $32,580,057 at the average monthly price of refined copper in New York 27.202 cents per pound. The production in 1915 was 100,785,150 pounds, and at 17.275 cents per pound, the average price for the year, would be worth $17,410,635. There was thus an increase in 1916 of 18,985,664 pounds, or 18.8 per cent. in quantity, and $15,169,422 or 87.1 per cent. in total value. An electrolytic copper refinery which has been installed at Trail began active operations about November 1 and has a capacity of 10 tons of refined copper per day. Of the total 1916 production 92,763,603 pounds were contained in blister copper and in matte, and 27,007,211 pounds estimated as recovered from ores exported. In addition to the recoveries from domestic ores there was also recovered in British Columbia smelters 5,551,166 pounds of copper from imported ores. The production in Quebec from pyrite ores was 5,707,200 pounds as against 4,197,482 pounds in 1915. These are the quantities reported as being paid for; the actual ore contents were much higher.

The Ontario production is derived chiefly from the nickel-copper ores of the Sudbury district and of the Alexo mine in Timiskaming, supplemented by a small recovery from the Cobalt district silver ores and by shipments made from six copper properties under development. The total production in 1916 was 44,997,035 pounds, as against 39,361,464 pounds in 1915, an increase of 12.5 per cent.

The British Columbia production was somewhat less than early estimates seemed to indicate. The quantity reported being 65,086,119 pounds, as compared with 56,692,988 pounds in 1915, an increase of 8,393,131 pounds, or 14.8 per cent. The 1916 production in this province included 17,904,282 pounds recovered in blister and matte and 17,181,837 pounds recovered from ores shipped to United States smelters. The Coast mines, including the Britannia, Texada Island and Anyox mines, together with the shipments from Hazelton, are credited with 43,048,065 pounds, and the Trail Creek and Boundary mines with 22,038,054 pounds. The increase in 1916 has been entirely from the Coast properties. The high price of copper has stimulated production from the White Horse district of the Yukon. Complete returns have not yet been received but the ore shipments were approximately 49,000 tons with a recoverable copper content estimated at 3,980,640 pounds. In 1915 the production from this source was 533,216 pounds.

The New York price of electrolytic copper increased from a minimum of 22½ cents during the first week of the year to 29¼ cents in May, falling to 22½ cents again about the middle of July. From that the price increased steadily to 33½ cents during the first half of December, closing the year at about 30 cents. The average monthly price was 27.202 cents, as compared with an average of 17.275 cents in 1915, an increase of 9.927 cents or 57.5 per cent. Higher prices for copper have not been recorded since 1873, when the average for the year was 28 cents.

Exports of copper according to Customs records were: Copper fine in ore, matte, regulus, etc., 124,942,400 pounds, valued at $20,776,536; copper in pigs, bars, sheets, etc., 2,430,400 pounds, valued at $581,268. There were also exports of old and scrap copper amounting to 5,846,600 pounds, valued at $1,284,895. The total value of the imports of copper in 1916 are recorded as $7,565,377, as against $3,957,770 in 1915. The imports in 1916 included 25,584,087 pounds of copper in pigs, ingots and manufactures valued at $7,565,377; other manufactures of copper values at $234,437 and copper sulphate $1,803,655 pounds, valued at $198,542. There was also a considerable import of copper contained in brass.

Increase or Decrease in Principal Products, 1916

Principal Products.		Increase (+) or Decrease (−) in Quantity.		Increase (+) or Decrease (−) in Value.	
			%		%
Copper	Lbs.	+18,985,664	18·84	+15,169,422	87·13
Gold	Ozs.	+ 8,907	0·97	+ 184,124	0·97
Pig iron from Canadian Ore (a)	Tons.	− 42,904	27·05	− 387,279	22·57
Lead	Lbs.	− 4,722,770	10·20	+ 947,149	36·52
Nickel	"	+14,649·907	21·45	+ 8,542,900	41·69
Silver	Ozs.	− 956,768	3·59	+ 3,625,793	27·41
Total metallic		....	......	+31,225,194	41·19
Asbestos and Asbestic	Tons.	+ 17,674	12·91	+ 1,585,494	44·35
Coal	"	+ 1,194,655	9·00	+ 6,746,375	21·01
Gypsum	"	− 133,197	28·05	− 124,098	14·52
Graphite	"	+ 1,336	50·70	+ 161,139	129·71
Magnesite	"	+ 40,634	274·94	+ 437,245	345·40
Natural gas	M. ft.	+ 5,114,406	25·41	+ 216,997	5·86
Petroleum	Brls.	− 17,341	8·05	+ 91,712	30·51
Pyrites	Tons.	+ 23,373	8·17	+ 98,829	10·03
Quartz	"	+ 8,695	6·84	+ 36,653	17·87
Salt	"	+ 4,133	3·45	+ 68,401	11·40
Cement	Brls.	− 321,982	5·67	− 447,163	6·41
Clay products		....	......	+ 282,445	7·22
Lime	Bush.	+ 435,632	8·63	+ 73,803	7·28
Sand and Gravel		....	......	− 126,758	7·80
Stone		....	......	− 376,938	8·88
Total non-metallic		....	......	+ 9,023,089	14·72
Grand total		....	......	+40,248,283	29·35

(a) The total production of pig iron shows an increase.

Government reports of Canadian foreign trade for the fiscal year ended March 31, 1917, show that Canada imported during that period a value of $6,342,490 of electrical merchandise. This compares with $4,896,106 for the previous year. Of the total, only $176,700 came from the United Kingdom, and 97 per cent., or $6,149,342, came from the United States. This sum includes the electrical business that originated in the United States and does not show the extent to which we depend on electrical goods manufactured in Canada by United States Canadian branches. Many of the larger manufacturers in the United States have Canadian branch factories where goods are made, or, frequently, assembled to avoid import duties.

Some Interesting Facts Regarding Industrial Fatigue—Shorter Hours Do Not Mean a Reduction in Output

In the recent report by Dr. H. M. Vernon to the Health of Munition Workers Committee much interesting information is given as to the injurious effects of excessive hours of labor, Sunday work, etc. It is proved that with a considerable reduction in the hours of labor and the enforcement of Sunday rest, the output may be actually increased. The "Electrician" prints the following:—

Dr. Vernon holds that this increase is not due—as many works managers maintain—to the determination of the worker to earn as much as was the case under the longer-hour system, for in such a case the worker's output would be increased immediately the reduction of hours occurred, instead of the increase occurring gradually. Even if money-making were the true mainspring of action, it is obviously better both for the health of the worker and for the conservation of the machinery, that an eight-hour day should be worked instead of a twelve-hour day, provided that the total output is maintained.

From observations extending over a period of 13½ months upon the output of workers employed in making fuses showed that a reduction of working hours was associated with an increase of production both relative and absolute. The rate of production changed gradually and did not reach an equilibrium value before the expiration of four months. Thereafter it remained steady for 3½ to 5 months. The gradual change negatives the suggestion that the effect was a mere consequence of the desire to earn the same weekly wage as before.

Owing to the reduction of the working time, first by a change from a 12-hour day to a 10-hour day, and subsequently by the abolition of Sunday labor, it was possible to compare output under three conditions. A group of women (numbering from 80 to 100) engaged in the moderately heavy labor of turning aluminium fuse bodies, provided the following comparative results:—

(1) When actually working 66.2 hours a week, and nominally 74.8 hours, their relative hourly production was 100, and their relative gross production 100; (2) when actually working 54.8 hours, and nominally working from 58.5 to 66 hours, their hourly production was 134 and their gross production 111; (3) when actually working 45.6 hours, and nominally working from 49.5 to 58.5 hours, their hourly production was 158, and their gross production 109.

It is therefore to be inferred that had these women been working uniformly a nominal 50-hour week their gross output would have been as large as when they were working a nominal 66-hour week, and considerably greater than when they were working a 77-hour week.

A group of 40 women engaged in the light labor of milling a screw thread on the fuse bodies improved their gross output by 2 per cent. when actually working 54.8 hours a week, the standard being their gross output when working 64.9 hours per week. A further reduction of actual working hours to 48.1 resulted in such an improvement of hourly output that the gross output was only 1 per cent. less than when the actual working time was 16.8 hours more.

A group of 56 men engaged in the heavy labor of sizing the fuse bodies improved their hourly output by 37 per cent. and their gross output by 21 per cent., when actually working 51.2 hours, the standards being the hourly and gross outputs observed when the actual weekly hours were 58.2.

Fifteen youths engaged in the light labor of boring top caps by means of automatic machines produced only 3 per cent. less when their actual weekly hours of work were 54.5 hours than when they were 72.5 hours.

In none of the operations studied was there any change either in the nature of the operation or of the type of machinery during the period under notice. The data was also so chosen as to eliminate any possible disturbances due to increasing skill.

A part of the improvement in output was due to the workers starting work more promptly when on shorter hours. At one period women engaged in turning fuse bodies lost on the average 37 minutes daily by starting work after and stopping before the nominal time. Nine months later, when their hourly output was 25 per cent. better, they lost only 26.5 minutes daily in these ways.

A rest from work on Sunday is followed by a relatively low output on Monday, and this output steadily rises in the course of the week, owing to the increased efficiency produced by practice. Generally the cumulative effects of fatigue neutralize and overpower this increased efficiency, and the output may fall after the second day (or night) of the working week if the hours are long and the work laborious, or not till after the third, fourth or even fifth day if the hours are shorter.

The Electric in Coal Mines—Figures Show a Saving in Haulage of Approximately One-Half

By A. Jackson Marshall.[*]

"Fuel oil is going to be less and less a competitor of coal in the far West," states the Coal Age. "The wells in California are fewer in number and shorter-lived than was expected. More by-products are being obtained from crude oil than in the past. This development is likely to continue even after the war ends. The result is going to be very high prices for what fuel oil is available. The action of one great railroad in forsaking oil and returning to coal is but the forerunner of similar action on the part of many other railroads and industrial plants. The Washington coal fields soon will be asked to supply eight or ten million tons of coal annually instead of three or four million."

An investigation by Mr. Floyd W. Parsons shows that about 1,100 new coal mines have been opened in the United States in the past fifteen months, and the question of labor is at present the chief problem of the coal industry. "Forty million men have been drafted from productive life and put to the business of making war. At least three men at home are required to devote their energies to supplying the needs of every actual fighter with food and weapons of destruction; which means we have turned the efforts of nearly two hundred million men to destroying civilization rather than to the attainment of any useful ends. No wonder the cost of food has gone up even in China and far-off India. If the war is to continue, we in America must now withdraw our quota of men from useful occupations. If we are to do as well as Canada and no better, we must send more than 3,000,000 soldiers to Europe, for we have 13 times the population of Canada."

One of the ways which Mr. Parsons suggests to meet this labor problem is to introduce machinery and labor saving devices. The electric industrial truck and the storage battery locomotive meet this emergency in a most satisfactory manner.

Today storage battery locomotives are being used both for gathering service and for main haulage. As one of these "electrics" will do the work of 3 to 8 mules, it displaces a large number of drivers who can be more profitably employed at the coal face. The cost of hauling coal and ore with storage battery locomotives is only about one-half what it costs to haul with mules or horses, and the mine output can be materially increased and the sanitary conditions improved by the use of this electric vehicle.

The Electric Vehicle Section, National Electric Light Association, has collected some interesting data showing the actual savings of the miniature electric locomotives over mule haulage in mines. The Madison Coal Corporation, one of the largest coal mining corporations of the middle West, which strongly advocates the use of the electric locomotive in coal mines, based on actual operating experience, states that in addition to the money saving in ton haulage, there is a remarkable financial economy in the prevention of injuries, for while their mule drivers form only five per cent. of their entire working forces, their accidents amount to 26 per cent. of the whole number, and the cost in connection with them amounts to 34 per cent. of the total liability cost. Some comparative monthly operating costs from the Madison Corporation follow:

Cost of Gathering Coal with Storage Battery Locomotives as Compared with Mules, Figuring that the "Electric" Displaces Four Mules

Mules

Feed and feeding 4 mules	$ 69.44
Four drivers, 162 hours each	230.04
Blacksmithing for 4 mules	3.84
Depreciation, 4 mules, life of mule 5 years	14.28
Veterinary and medicine, 4 mules	3.60
Harness	3.60
Driver boss, 4 mules	18.00
Total cost to maintain 4 mules with drivers	$342.80
Tonnage gathered with 4 mules during one month, 8,368 tons. Cost to gather with mules and drivers	$.04096

Storage Battery Locomotive

Maintenance cost of batteries one month	$ 30.00
Maintenance cost of mechanical equipment, one month	12.50
Motorman, 162 hours	68.44
Trip rider, 162 hours	57.51
Charging batteries, 20 hours, one hour each night mine work	6.55
Oil	.20
Cost to maintain S. B. Locomotive one month	$175.70
Tonnage gathered with S. B. Locomotive during one month, 8,900 tons.	
Cost to gather with S. B. Locomotive during one month	$.01974
Current, 73 kw. at 1½c per kw.	.00125
Total cost to maintain and gather with S. B. Locomotive	$.02099

Cost to gather with mules, per ton	$0.04096
Cost to gather with S. B. Locomotive	$0.02099
Difference in favor of S. B. Locomotive	$0.01997

The Pocahontas Smokeless Coal Company of West Virginia is also successfully operating storage battery locomotives. At their mine four cars, each weighing 1300 lbs. empty, and 4100 lbs. loaded, are hauled on each trip by one electric storage battery locomotive, on main entry, a distance of about 2500 ft., including 1200 ft. against 3 per cent. grade, 400 ft. against 2½ per cent. grade, and short grades 5 and 7 per cent., all against the loads. To secure the 400 tons a day that this mine should produce, the mule haulage would cost $735 a month and battery haulage $306 a month, making the very substantial saving of $429 a month in favor of the "electrics." Furthermore, the maximum number of mules and cars allowed by the track conditions could not handle 400 tons a day. The upkeep on ties and track was quite considerable with the mule haulage.

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[*] Secretary Electric Vehicle Section N. E. L. A.

Collecting Overdue Accounts by Mail

Central Station Managers Must be as Proficient in Collection as in Distribution—The Art of Letter Writing

It is one thing to supply electric service and quite another to collect the accounts, and the central station, to be a financial success, must be equally proficient in both. In these days of almost universal electric supply when the poorest as well as the richest citizen enjoys the advantages of light and power at small cost, the distribution of accounts and the collection of payments is a source of very considerable leakage in revenue if not watched with the greatest care. When the supply was confined to a few and the amount of the monthly bills was considerable, the cost of collection was, by comparison, a less important factor. However, the inclusion of so many small consumers, which keeps the average bill anywhere in the neighborhood of fifty cents to a dollar per month, opens the way, as noted above, for big savings or big expenses according as the problem is economically handled or otherwise.

The average consumer, unfortunately, does not stop to consider this other side of the matter. When he gets his bill for 70 cents or so for the brilliant illumination of his home for several hours per day for a whole month, including, in all likelihood, the use of an iron and toaster and other small power consumers, he is inclined to look upon it as clear gain to the central station organization. He forgets the tremendous cost of the machinery and equipment involved in this supply; forgets that, though he turns his current off and on at will, this machinery must stand ready day and night, winter and summer, to supply his maximum demand on no greater notice than the snap of a switch, forgets the labor and cost of reading his meter; and delivering his monthly bills—just the same for the 70 cent customer as for the $70 one. He not infrequently resents the fact that he must make payment by a certain date, delays a day or two and works himself into a righteous wrath when the receiving teller hesitates to allow him his prompt payment discount. All these and other things of like nature make the path of the central station all too sparsely strewn with roses and drive home to all of us the necessity for still greater educational work among customers in general that both sides of this very much one-sided question may be presented to them in proper perspective.

But the climax is reached by the customer who fails to pay his account at all. Of course, this represents a small percentage of the total and unless such a one is moving out of town, or has an alternative source of electric supply upon which he can sponge, temporarily at least, he can generally be brought to task. There are those who escape, however, and about the only resort then is to correspondence.

It is here that the art of letter writing gets its severest test. Modern business principles demand that the letters be courteous, tactful and convincing. No large organization can afford, in these days, to make an enemy, even of a runaway debtor. "The friendship of a dog" is an old saying, but fully applicable here. The letters must make a friend at the same time that they must collect the account. It is no easy task.

In quite an interesting way this very matter was recently treated by Mr. Haver, credit manager of the Southern California Edison Company, before a meeting of the employees of that company. He makes two splendid points, (1) skill and care in wording the letter; (2) promptness and regularity in following up. Copy of actual correspondence was also given exemplifying his arguments. Central station men everywhere may learn something from Mr. Haver's remarks, which, in part, were as follows:—

Do Not Reprimand

Successful collecting by mail is dependent on two things —care and skill in wording each individual communication to the debtor; promptness and regularity in sending and following up correspondence. Correspondence is usually sent out without sufficient thought or by some one inexperienced in the work. Too frequently such letters are in effect a reprimand to the debtor for not having paid, instead of a suggestion of the reasons why he should pay. Quite often letters are sent out at the convenience of the writer, instead of being sent at a time which has been carefully chosen in a well-thought-out collection scheme.

The experience of men who have given this subject much thought shows that a simply worded, courteous letter, putting the facts up to the debtor in a direct man-to-man fashion, will produce the best results. In wording a collection letter keep first in mind the old adage, "You can catch more flies with molasses than with vinegar." Try to figure out the kind of a man your debtor is and then place yourself in his position. Keep the pronoun "I" subservent to the pronoun "you." If a threat must necessarily be made, do not emphasize it too strongly, but try to bring out the reasons why the debtor should avoid the action threatened. Observe carefully the general rules of correspondence. In writing to a business man use as short and concise a letter as possible. In writing to a farmer, and especially to a woman, a longer letter, explaining the situation more fully, will be permissible. In writing to persons of limited education use short words and explain your thoughts in a simple way. Use short sentences, not too involved. Use short paragraphs, with the most important arguments in the first and last paragraphs. Avoid hackneyed phrases, such as "we beg to acknowledge," "your kind favor," "thanking you in advance," "we beg to remain," etc.

Delays are Dangerous

The most difficult accounts a utility has to handle are closing bills against people who can no longer be reached by a personal call. Discussing a plan for handling such accounts, I want to emphasize the importance of collecting all closing bills, if possible, at the time the closing reading is taken. A little trouble spent in getting our money at this most opportune time will save much work and postage later on. Closing-bill collectors should be thoroughly instructed and schooled in this important duty.

If the bill cannot be collected with the closing reading, we must depend upon the results of future calls or resort to an effort to collect by mail. To assist in caring for the conditions arising from such accounts most companies have adopted standard form notices. These afford a basis on which to start correspondence with the debtor. They may in themselves be sufficient to bring in the money, but should only be considered as a means of getting in touch with him. It must be remembered that as soon as a reply is received in response to a form letter the efficacy of any subsequent form is lost, and the subject then becomes one of special correspondence until the account has been collected. When a consumer replies to one of our notices, his reply, no matter what he says is the collector's golden opportunity. In the majority of cases collection can be made if the case is properly handled from that point on. Even if his reply is a well-worded tirade against corporations and a general denial of his debt, he has acknowledged something in answering the letter and afforded a basis for further correspondence, which, if properly handled, will result in payment of his account or afford an opportunity of making a friend, if, as in rare cases, it is found that the account is not properly chargeable to him.

Concentrating the Responsibility

To accomplish this, it is highly important that one person be placed in charge of all collection correspondence and that he have sufficient time to take care of this duty regularly each day; that a complete record be kept of all correspondence sent out and the dates thereof and of the results of all personal calls by collectors; that any communication from the debtor be recorded immediately; that all the facts contained in such a record be in mind whenever a letter is dictated; that every possible argument be brought forth to make him pay. For instance, if a debtor has written in that the bill is too large or that some one else owes it, it is useless to write him again if you are going to ignore the claim which he has set up. His contentions must be answered and additional arguments put before him to show why he personally owes the account.

I have said before that our correspondence is never considered closed until we have got the money and, if possible, left the consumer in a friendly frame of mind. We are not satisfied with getting the money and leaving the debtor with a grudge against the company, feeling that he has been obliged to pay a bill which he does not owe or that he has been overcharged. In many instances we have spent as much time and postage in straightening out our relations with the debtor, after the account has been paid, as we did in getting him to send in his remittance. To illustrate this, I will read the correspondence we had with one of our consumers who had moved away leaving an unsettled bill:

A Typical Case

"Venice, Cal., Oct. 9, 1916.

"S. C. Haver, Jr., Credit Agent,
"Southern California Edison Company.

"Dear Sir—In re yours of the 7th inst. Beg to state that the bill would have been paid many months ago if the man I spoke to at the time I moved (at your office) hadn't been quite so officious. At the time that I moved I really couldn't spare the amount of the bill. I will take care of same within a few days. Yours truly, John Doe."

* * *

"Los Angeles, Oct. 14, 1916.

"Mr. John Doe, 2214 Walnut Avenue, Venice, Cal.

"Dear Sir—Referring to your letter of Oct. 9 in regard to bill of $1.21 for service at 2226 Fifth Avenue, Los Angeles. I am sorry you feel that you were not properly treated in our office at the time you moved from Fifth Avenue, as our employees are all instructed to observe the greatest possible courtesy in caring for the wants of our customers. Will you please accept our sincerest apology, and I may safely say that you will not have another such experience in any of our offices. In regard to the amount which you owe, I hope you will find it convenient to send me a remittance on or before the 20th of this month. Yours truly, Credit Agent."

* * *

"Venice, Cal., Oct. 16, 1916.

"Mr. S. C. Haver, Jr., Credit Agent,
"Southern California Edison Company.

"Dear Sir—Your letter of the 14th very much appreciated. I am sorry for my own actions in this matter; it was too small a thing to warrant my going as far as I did. Inclosed please find check for $1.21. Yours in appreciation, John Doe."

* * *

"Los Angeles, Oct. 23, 1916.

"Mr. John Doe, 2214 Walnut Avenue, Venice, Cal.

"Dear Sir—We acknowledge with thanks receipt of your check in the amount of $1.21 to cover closing bill for service at 2226 Fifth Avenue, Los Angeles, and inclose herewith receipt to cover. We regret any inconvenience which this matter may have caused you, but such instances have at least one advantage—namely, that of putting a large corporation such as ours in closer touch with at least one more of our consumers. We are in business in many cities in southern California, and it is always our desire to maintain friendly and frank business relations with every one. I sincerely hope that you will continue to favor us with your patronage, wherever you may be in need of electricity for lighting or power service, and assure you of our desire to render you the best possible service at all times. Yours truly, Credit Agent."

Bonus Plans Adopted by Electric Company

Robbins & Myers employees will welcome announcement that has been authorized by officials of the company, to the effect that two new bonus plans for employees have been adopted by the company, and have already been placed in operation, becoming effective under date of August 1, 1917. Under these two plans all employees are offered splendid opportunities of materially increasing their earnings.

Believing that the maximum degree of efficiency can be obtained by complete crystallization of the spirit of co-operation, and believing that the new arrangement will offer an incentive to all employees to put forth their best efforts and take more personal interest in their work, the company has taken this step of giving its employees the two bonus propositions. Both plans have become effective as of August 1st, and pay days falling in September will bring bonuses to those entitled to them under the "Perfect Attendance" plan, while "Service" bonus payments will start on September 25th.

Under the bonus plans, perfect attendance for thirty-day periods will bring bonuses ranging from three to five per cent. of the monthly wage or salary, while length of continuous service of employees will bring bonuses of from one and a half per cent. to ten per cent., the percentage being based upon the number of years of service.

The two plans are entirely separate and yet operate together. Plan No. 1 is known as the "Perfect attendance" bonus plan. Plan No. 2 is known as the "Service" bonus.

Under Plan No. 1, any employee with a record of thirty consecutive and perfect days for attendance and time punched in and out, will be given a bonus amounting to three per cent. of his straight time earnings for that period. If any employee has a second successive thirty-day period, the bonus will be increased to four per cent., while five per cent. will be given for a third successive thirty-day period of perfect attendance. Thereafter if the record is continued, the bonus will continue at five per cent

Here is the schedule of bonuses under plan No. 1:

First 30 days' full attendance, 3% of straight time earnings.
Second successive 30 days' full attendance, 4% of straight time earnings.
Third successive 30 days' full attendance, 5% of straight time earnings.
Thereafter for continued perfect attendance, 5% of straight time earnings.

The first payments under the "Perfect Attendance" bonus plan are to be made about the middle of September, the bonus period to constitute the month of August. Thereafter these bonuses will be paid regularly upon the tenth of each month for the preceding month's record.

There are certain rules governing this bonus plan, infractions of which will destroy records, and in such cases employees will begin on new records counted as the first thirty days. Here are the infractions which will destroy attendance records: One time late, one absence, washing up before quitting time, stopping work before quitting time, failure to start promptly at starting time.

No excuses will be countenanced in this attendance bonus plan. Sickness, absence from work for any cause whatsoever, tardiness, punching out before quitting time, or failure to start work promptly, will destroy attendance records. If any employee's record is broken he will immediately start on a new one counted as the first thirty days. The records will be kept from the time clocks which must be punched by all employees, including office employees. At present there are no time clocks for office employees, but they have been ordered and will be installed as soon as possible.

The "Service" Bonus Plan

Under Plan No. 2, known as the "Service" bonus plan, employees will be given bonuses for faithful service in the company's employ, the amount of bonus to be determined by the length of continuous service. This plan also becomes effective as of August 1st, and the first "Service" bonus payments will be paid on September 25th, and will be based upon the August earnings. Thereafter these bonuses will be paid quarterly, and the payments will fall due December 25th, March 25th, June 25th, and September 25th.

Here is the bonus schedule based upon length of service:

6 months' continuous service	1½% of earnings
1 year's continuous service	2 % of earnings
2 years' continuous service	4 % of earnings
3 years' continuous service	6 % of earnings
4 years' continuous service	8 % of earnings
5 years' continuous service	10 % of earnings
And thereafter	10 % of earnings

This bonus will be figured upon the total earnings during the quarter it is paid for, and no over time will be included in figuring such bonuses.

Present standing of employees as to length of service is to be recognized at once in the "Service" bonus plan. For instance, any employee of the company who has been there five or more years, will receive a 10 per cent. bonus to start with. An employee of six months' standing will get a 1½ per cent. bonus, and the scale given above will apply in all cases. This bonus plan applies to all employees, including those in branch offices.

There are numerous minor details of the bonus plan still to be adjusted by the officials, but everything will be in operation so as not to delay the first payments. Several points have been raised and passed upon. If any employee leaves the company during his "Perfect attendance" period he naturally loses his bonus. If any employee is injured and has to be away from work because of such injury, it is thought some equitable arrangement will be made, for the company has taken the attitude that an employee's perfect attendance record should not be destroyed by absence due to an injury received unavoidably in the factory.

Fine Showing for Electric Vehicles

The "Electrician" prints the following figures received from Mr. J. A. Priestley, cleansing superintendent at Sheffield, of the travelling time of horse vehicle, petrol wagon and electric vehicle over a measured mile, with stops as follows:—

	Total travelling time.
Horse and Cart	
Stopping every 10 yards	33 mins., 31 1/5 secs.
Stopping every 20 yards	32 mins., 24 secs.
Petrol Wagon	
Stopping every 10 yards	14 mins., 48 secs.
Stopping every 20 yards	10 mins., 51 1/5 secs.
Electric Vehicle	
Stopping every 10 yards	11 mins., 20 secs.
Stopping every 20 yards	9 mins., 20 secs.

Average time taken by each vehicle to cover 10 yards and 20 yards distances from starting to stop:—

	10 yards.	20 yards.
Horse and cart	11.4 secs.	22.1 secs.
Petrol wagon	5.0 secs.	7.4 secs.
Electric vehicle	3.8 secs.	6.3 secs.

Two-ton vehicles were used in each case.

Cultivating Foreign Trade

The war has created opportunities for Canadian manufacturers to extend their export business. The cutting off of German supplies and also to a certain extent of British and allied products, has resulted in buyers looking more and more to the North American continent for goods hitherto supplied by European countries. For example, shortly after the commencement of the war, the Duncan Electrical Company, Limited, Montreal, commenced to cultivate foreign trade in switches, etc., and they have now extended this part of their business. Certain lines made by German houses have been improved on, and, with other goods, are being sent to European countries and to South America. Folders and catalogues are printed in English, French, Spanish and Portuguese, and are widely distributed in the various countries. The company are thus appealing to foreign consumers in their own language, and avoiding the mistake of many British and United States firms who wasted a large amount of money and labor by sending out printed matter in English. The result was naturally that the catalogues were simply thrown into the waste-paper baskets. Mr. Duncan states that he has received replies from all parts of the world and that the orders are increasing in volume.

Electric Club Resumes Luncheons Sept. 21

The Electric Club of Toronto will hold its first autumn mid-day luncheon on Friday, September 21, at the usual time and place—12.30 noon, Prince George Hotel. This may well be considered the most important meeting of the year, as it is, in effect, the annual meeting at which, according to the constitution of the Club, the new Governing Committee is elected, as well as the other officers of the organization. A number of important questions regarding the scope and administration of the Club will also be up for discussion, and it is urged that every member should make a special effort to be on hand. Any person who is connected in any way with the electrical industry is eligible and welcomed to membership. Remember the date—Friday, September 21.

Electric Railways

The Manufacture, Life and Maintenance of Tramway Tires—Valuable Experience of a British Company Covering a Number of Years

Following an article in the last issue of the Electrical News on the practice of the British Columbia Electric Railway Company in fitting new steel tires to car wheels, we are printing some extracts from a very complete article read by Mr. Arthur Norton, Assoc. Mem. Inst. C. E., before the Tramways and Light Railways Association's ninth annual congress, held in London, June 29, 1917. The article is entitled "The Manufacture, Life, and Maintenance of Tramway Car Tires," and the following extracts deal particularly with the installation and maintenance. The re-tiring of iron centres is a practice of many years' standing in England, though comparatively rare in this country. It follows that their experience is of extreme value to Canadian railway men, who may be interested in this phase of maintenance:

Gauges and Gauging

The accurate gauging of the bore of the tire is of extreme importance, as it is very essential that the standard shrinking allowance of one-one thousandth of the diameter of the wheel centre shall not be either above or below the limit fixed. It is a moot point whether sufficient importance is attached to this question, as also to the use of a really suitable material for the manufacture of gauges; for it may be pointed out that the surface points of both the inside and outside diameter gauges being so small, a certain amount of wear is inevitable, which can be easily added to by the rough usage to which such gauges may be subjected in the hands of rough and careless workmen. Some such special steel as "Quickstep," with hardened and tempered points, would suit admirably for this purpose.

It is also of great importance to have the master gauges kept in safe custody, so that the gauges used in the shops may be proved from time to time. Unless this precaution is adopted, the contraction allowance, on the inside diameter gauge, may very readily be exceeded, with the resulting consequences of broken spokes in the wheel centres, or even the actual bursting of the tire. This is especially liable to occur in those cases where more than the standard allowance for contraction has been allowed.

There are records where as much as 1/8 in. allowance has been made in tires for contracting on to centres (with straight spokes), having a diameter round about 26 inches, to which allowance may be added a possible further amount due to the worn state of the gauges, as indicated above.

The allowance for contraction in a tire would no doubt have to be increased when wheel centres are designed in such a way that the rims are not in alignment with their bosses, wheels designed in this way being provided with "S" spokes, and the contraction of the wheel centre will, therefore, vary according to the greater or less degree of the curvature of the spokes.

Apparatus for Recording Expansion and Temperatures

An apparatus has been designed for correctly recording the exact amount of expansion and contraction that takes place at the varying temperatures upon heating and cooling a tire. By means of this recording apparatus, as applied on a 2¾-in. standard section tram tire of the following dimensions, 31 in. outside diameter, 25-23/32 in. inside diameter, the expansion and contraction that took place were most carefully recorded. The expansion and corresponding temperatures that were recorded were as follows

Expansion.	Temperature.
3/64 in.	220 degrees C.
1/16 in.	250 degrees C.
1/8 in.	400 degrees C.
5/32 in. full.	500 degrees C.
3/16 in.	600 degrees C.

It is frequently remarked that tires are put on at a "black heat," but it may be instructive to point out that, given a good light, a "black heat" may carry a temperature of 550 degrees C. to 600 degrees C., although if the shop be badly lighted, this latter temperature would be a visible red.

A temperature of 650 degrees C. would show a visible red in a well-lit shop, but in the case of tires that have been subjected to careful heat treatment the whole effect of that operation may be nullified by exceeding the safe temperature of 400 degrees C.-420 degrees C. mentioned below. Also at 650 degrees C. one is getting dangerously near the calescence change point, when the condition of the steel is completely changed owing to the diffusion in the pearlite areas, and at such temperatures quenching would have the effect of partly hardening the tire. This calescence change point is shown in the heating curve round about 740 degrees C., and in the cooling curve at 680 degrees C. Should the calescence change point be exceeded, and the tires cooled off by the ordinary hose-pipe method, the tires will develop hard and soft places, with the result that flats are very much more readily induced when the tire comes to be put into service.

Having fixed the necessary contraction, and knowing the required temperature that is necessary to contract the tire on to its wheel centre, it is of importance to see that the temperature so fixed upon is not exceeded, and it may be emphasized that it is undesirable to go beyond the safe limit of 420 degrees C., this being the melting temperature of zinc, and can therefore be very readily checked, as described below.

Method of Heating Tires Prior to Shrinking

The tires, having been bored to the correct diameter on the tire-boring mill, are then heated on a gas ring arrangement, which shows the actual fixing of a gas ring into a tire prior to heating. This arrangement allows the tire to be heated to the exact temperature required, the latter being readily checked by placing one or two small pieces of zinc on the face of the tire, the zinc being suitably covered with a metal cup, so as to retain the heat, the cup being removed momentarily in order to see if fusion has taken place.

As pointed out, it is not necessary to heat the tire to this temperature, as 1/16 in. expansion takes place at 250 degrees

C., and the tire can be very readily gauged when heated. Care should be taken to see that the desired expansion consequent on the temperature is not exceeded.

We now come to the point when the wheel centres already pressed on to the axle are carefully turned to the required diameter, the method thus adopted ensuring the wheels being concentric with the axle. A method has been designed by the Sheffield Corporation Tramways for lifting the wheels and axle into position over the heated tire, the actual lifting being accomplished by very quick acting block tackle. The wheel centre is then lowered into the tire, and the general practice adopted for cooling off the tire is the rather primitive one of applying a stream of water by means of a hose-pipe, administered by hand.

Even Temperature During Cooling

As every precaution is taken in the process of manufacture to keep the temperature of the tires uniform, it may be pointed out that this method is liable to produce unequal distribution of cooling stresses. A better method is to allow the tires to cool off slowly in the atmosphere, but this is not always possible, owing to the time that is required for such an operation. It is, therefore, advisable to instal a perforated ring, and through the perforations provided water is allowed to play freely on to the surface of the tread of the tire.

Removing Worn-out Tire

The method adopted in Belfast for removing a worn-out tire is to place the wheels in such a position that the gas plays freely on the tread of the tire, the time required for the operation, from the time it is placed inside the gas-ring, being seven minutes.

Fixing Tire By Means of Studs

The practice of fixing the tire to the wheel centre by means of studs was formerly in more or less general use, but on such big systems as Glasgow it has been discarded altogether as being unnecessary. There is grave objection to boring holes in tires, necessitated by the above practice, as each of the holes forms a notch in the body of the tire, from which fractures may readily start, and especially in those cases where the tire is nearing the end of its life.

Flats on Tires

One great advantage of the adoption of the steel-tired wheel over the cast-iron chilled wheel has been the comparative freedom from flats, which so readily obtained in the latter, especially when the chilled portion had worn away, but no doubt the opportunities of producing them at the present time may be more frequent, owing to the type of labor available for drivers being possibly not quite so skilled as in the days preceding the attempt of the German emperor to rule the earth.

Maintenance of Flanges

In considering the question of tire wear it is always important to remember that the wheel flanges play a very significant part in steering the car through the various points, crossings, and curves, and it therefore becomes a matter of vital importance to see that the flanges are properly maintained so as to avoid any risk of derailment, with more or less serious consequences. In addition, the amount of side-play is reduced—an important consideration when one takes into account the increased wear to both tire and rail, which is bound to take place when too much lateral movement is allowed. It is therefore advisable to send the wheels into the shops for re-turning at that point in their lives, when the flanges can be reformed with the least possible loss of metal on the tread, and for further guidance it may be useful to quote the practice adopted in Belfast, which may be summarized when any of the following conditions obtain:

1. When the tires on one pair of wheels have worn to different diameters.
2. When the inside of the flange becomes approximately at right angles to the tread, thus forming a definite corner on the tire.
3. When the flange becomes more than 3/16 in. above or below the standard section of flange of the original tire
4. When the flange at its base is less than ⅞ in.
5. When the tread of the tire is worn with a considerable hollow.

In re-turning worn tires it is not the general practice to re-form the profile to its original contour, as it is argued if this were done it would necessitate cutting too much valuable material away, which, in turn, would shorten the life of the tire.

Outside Diameter Gauge

For gauging the diameters of tires the gauge points should always be fixed at a certain distance from the outer face of the tire. By this method absolute continuity in recording the wear of tires is obtained, as it is from the point thus obtained on the section that the profile of the worn tire is drawn and the life due to wear recorded. In certain cases, when calculating the mileage result, the amount of material cut away to re-form the flanges and to pair the tires is included with that which has been lost owing to wear. This method cannot altogether be described as satisfactory, as the actual loss due to wear should only be considered in arriving at the mileage results. In this connection it may be well to emphasize the fact that when the diameter of one wheel is found to be wearing smaller than the other, it is better that such difference should be corrected as soon as possible, the flanges being re-formed to their original section at the same operation. When tackled in time the amount of material that is necessary to cut away from the body of the tire to re-form the profile is so very much less than would be the case when one wheel was, say, half an inch smaller in diameter than the other; and it is always well to bear in mind the adverse effect that such a pair of wheels must have on the track, etc.

The mileage obtained from these two sets (sections of which were shown) was 73,106 in the first case and 84,070 in the other; or, taking the worst-worn tire in each set, you get 4,873 miles per ⅛ in. wear in the first case and 5,604 in the second. It may also be noted that in the case of Car No. 343, No. 2 end, there is a difference of ½ in. in the diameter of one wheel as compared with the other, the result being that the smaller wheel has to travel 1½ in. further than the large one at each revolution.

The difference has to be made up by continual slipping, thus causing excessive wear to both tire and rail, excessive consumption of current, to say nothing of our very old and esteemed friend, "rail corrugation." It therefore follows that the ratio of wear of the smaller tire is increased as its diameter decreases, with the added consequence of flange creeping, which again emphasizes the importance of re-turning and pairing the tires more frequently during their life.

With reference to mileages obtained on two other examples, where the records are being very carefully noted, for the first period run a mileage of 8,000 miles per ⅛ in. radial wear was obtained, whereas for the second period an approximate wear of 6,000 miles per ⅛ in. is shown, or a reduction of 25 per cent., due, no doubt, to the reduced width of the worn flanges, for, owing to the extreme shortage of labor, owing to war conditions, it was found impossible to turn the tires after the first period.

Limit of Wear

The life of a tire is generally concluded when its thickness is reduced to ¾ in. or ⅞ in., although there are cases on record where that limit is exceeded, e.g., a pony tire was run until it had practically worn through, the thickness being about ⅛ in. to 3/16 in.; and a driving tire down to 7/16 in.; but the flanges in both cases were wonderfully well maintained.

Women as Conductors and Motormen—Their Success Varies Greatly with Local Conditions—Conductors Most Satisfactory

By Archibald Robertson

The question of using women as conductors and drivers on electric railways is, of course, more pressing in England than in Canada, but a discussion which took place at a convention of the Tramways and Light Railways Association, recently held at London, is of interest as showing conditions in the British Isles. There was by no means a unanimity of opinion that women were satisfactory substitutes for motormen, although as conductors there were comparatively few failures. Much appears to depend upon the topography of the country, as, apparently, the girls are apt to lose their heads and wring their hands at sharp curves, heavy grades, or slippery rails. It must also be remembered that in certain section of England the passengers are rather rough, and, in the absence of prohibition, somewhat more difficult to handle than would be the case at the present time in our own country. The following brief article by Mr. Archibald Robertson, manager of the Greenock and Port of Glasgow Tramways, expresses conditions on his own line:

I believe the Greenock and Port Glasgow Company was one of the first, if not actually the first, tramway company to experiment with women drivers and conductors. It will be readily understood that this was not from any desire to make a change, but from absolute necessity. On the outbreak of war a considerable proportion of our men at once enlisted, and as the various shipbuilding yards were very busy and paying high wages, men could not be got to fill the vacancies. A considerable proportion of our pre-war running staff were double-ended. Conductors who had qualified as drivers were at once put on to drive, and we set about training the men who had not already qualified as drivers, meanwhile filling up the vacancies on the back platform with selected women. As time went on more men left, until we were faced with the alternative of putting on women drivers or drastically curtailing the service; and, considering that about 70 to 75 per cent. of our traffic is munition workers' traffic, it will be readily agreed that stoppage or serious curtailment would have been disastrous. After very anxious and careful consideration—and, I might add, with considerable trepidation—it was decided to train a few selected women as drivers. The lady superintendent of the local labor exchange gave us valuable assistance in selecting the proper type, and, after about four weeks' training, the first batch of half a dozen was put on the road in charge of cars. The number was steadily added to, until we had something like 80 per cent. of women on the running staff—that is, conductors, drivers, and checkers. Sixty-two per cent. of drivers were women. I do not know whether the military authorities in the north are more exacting in their demands than in the south, or whether our men volunteered more readily, but I know that but for the assistance of the women it would have been impossible to have maintained anything like a full car service.

Easily Handle 12-ton Cars

The experiment of putting women on the front platforms was an immediate success. The first lot received perhaps a longer period of training than some of the later lots and probably a little more attention than is usual in the cases of male drivers. After a month's training they were as efficient as good-class men with a similar period of training, and much superior to the class of men procurable nowadays. In Greenock, while we have no very steep hills, the cars are large 12-tonners, seating 74; the main streets are narrow, and congested; vehicular traffic is heavy, and in parts the track is single, with loops; so it says much for the capability of the girls that there is hardly an accident recorded against the first batch—certainly not a serious accident. The tramway system runs round the fringe of the town, alongside the river and the Firth of Clyde. The larger proportion of the residential district is on the side of a somewhat steep hill, away from the car track. The shipbuilding yards and other large works are alongside or near the track. The people from the residential districts find their way down to the main street, which, particularly in the evening, has the appearance of a busy market square. Consequently, to drive a heavy 12-ton car successfully requires both skill and nerve. I have already said that the first lot of drivers had a good record in regard to accidents, but this early good record has not been maintained in its entirety. Some of the later girls apparently think they have as good a right to have a "dunt" at a lorry as their male colleagues have. Some of the later lots of girls trained were as a whole hardly so satisfactory as the first lot, although many of them individually were quite as good.

We were somewhat concerned as to how the drivers would stand the winter. Greenock has a somewhat unenviable reputation in regard to rainfall, and storms are not unknown. The route is fully exposed to the gales which blow down the lochs branching off the firth. Here, again, I was agreeably surprised. While the "missed turns" were more frequent than during the summer, necessitating a larger duty sheet, the girls stood the cold remarkably well. Rain and snow did not daunt them; the only conditions which seemed to frighten them was a "greasy" rail. There were more failures to report on a mild morning when rails happened to be "greasy" than on wet and stormy mornings. With the object of making the fronts of the cars more comfortable, we had vestibules fixed, but they were not wanted, and, in fact, the girls preferred the cars without them. Arrangements were made under which the crews on the late long shifts during winter got a cup of tea and a biscuit between 7 and 10 p.m. This appeared to be appreciated. When it was suggested that the hours worked per week should be reduced, it was found that they preferred to work similar shifts to the men. They are paid by the hour, and you would be surprised to learn the hours worked by some. While the experience has generally been favorable, there are one or two points that occur to me where they are perhaps not so reliable as men. While some of them have not lost a single minute's time in the course of twelve months, a proportion of them do not realize the necessity for punctual reporting. They appear to think that if they report within ten or fifteen minutes of the reporting time there should be nothing to complain about, and even when they do not turn out for work they sometimes neglect to send word.

Not so Reliable in Emergency

I do not think that a girl is just as satisfactory in case of sudden emergency as a well-trained man. As a rule, a large proportion of them are more "nervy," although there are cases when they have acted as coolly and efficiently as a man could. A sudden fright appears to take more out of them. I have known cases where a woman to avoid an accident has acted in every way absolutely correctly, stopped the car, and afterwards fainted away. In this connection it must be kept in mind that women drivers are a recent innovation, while the staff of male drivers is the product of years of training and practising (a few new ones being added occasionally), so that with men the right thing to do in every case is done almost automatically and without the necessity of thinking. In the case of women entirely new to the work, this was at first not so, and in this respect they may be considered inferior to men; but, with longer experience, they have become more efficient, until now they are very little, if anything, inferior. You cannot, of course, put a large number of untrained women (or men, for that matter) to any work to which they have not been accustomed and have them as efficient in a few months as others who have been years at the work. One might just as well expect a crowd of female workers in engineering works to be as expert fitters as men who have served five or six years' apprenticeship.

The innovation was received well by the public, and the girls got on fairly well with the passengers. Much depends on the manner and disposition of the individual girl. It has been noted that the greatest grumblers are women, and that the male workers have been, with few exceptions, courteous and forbearing, especially when they are comparatively new to the work.

In conclusion, I might say that, in my opinion, so far as the running of the cars is concerned, these could generally be fairly efficiently worked by women, provided there is plenty of time given to train them properly and that the proper type is selected. It is advisable, however, that a proportion of the drivers be reliable men; this is to ensure assistance in case of accident. In training women drivers it will probably be found necessary to reject a larger proportion than in the case of men, and, of course, some systems are more favorable for experiment than others. Work on a level track is easier. Considering that in three or four months 50 per cent. to 60 per cent. of drivers were replaced by women, who had until then never thought of working a car, the results have been wonderful. In Greenock we were fortunate in that the few male drivers over military age left with us were good and sensible men. They did their utmost to assist in training the women, so that munition workers' service could be maintained. Without the assistance of the men our difficulties would have been much greater. We have also a few women driving our big commercial omnibuses. This is a recent innovation (a couple of weeks), but they appear to be shaping all right. The following are our complete figures:

Percentage of female drivers—Greenock, 62 per cent.; Rothesay, 71 per cent.; Coatbridge, 33 per cent.

Percentage of total female running staff—Greenock, 69 per cent. (76 per cent. leaving out spare time men); Rothesay, 59 per cent.; Coatbridge, 54 per cent. (65 per cent. leaving out spare time men).

The Effect of the Six-Cent Fare on Traffic and Revenue as Shown by a Number of Companies

Some months ago Professor Thomas Conway, of the University of Pennsylvania, was requested by the Special Committee on Ways and Means to obtain Additional Revenue, representing some 28 electric railways situated within the 22nd public service district of the State of New York, to make a study of the conditions resulting from an increase in fares from five to six cents, judging from the experience of the companies that had inaugurated this rate. The report is outlined in a recent issue of the Electric Railway Journal and the general conclusions are as given below. Professor Conway finds that in every case the gross revenue is increased, though not in any instance in proportion to the increase in fare. The dropping off in the number of fares offsets the theoretical increase by approximately one-half. This result is for the early months of the newly inaugurated fares. Results show that after a time the public become accustomed to the larger rate and resume their old habits, and the supposition is that after a year or so the total revenue should be in proportion to the rate, that is, an increase of approximately 20 per cent.

Conclusions As to the Effect of a 6-Cent Fare

A review of the foregoing data shows clearly that 6-cent fares bring about an increase in operating revenues under practically every condition. There is, of course, a difference in the extent of this increase, dependent upon local conditions and also upon the general industrial situation at and subsequent to the time the higher rate became effective. The real effect of 6-cent fares has, in many cases, been obscured because of the fact that they became effective at about the time of some such marked change in industrial conditions as, for example, that occurring just prior to the outbreak of the European war.

Apparently there is no record of a company whose earnings have been increased in proportion to the increase in the rate of fare—that is, by, say, 20 per cent. A 6-cent fare reduces travel, and if a generalization is possible on the evidence thus far available it seems to point to the conclusion that the reduction in travel is approximately 10 per cent.; or, in other words, roughly speaking, a 6-cent fare brings about an increase in revenues of something more than 10 per cent. In some cases increases in operating revenues are less than this amount, due to local conditions. A line operating in a small city, where the average ride is short, apparently suffers a larger reduction in travel than a line operating in a large city, where the average ride is long. The reduction in travel concerns almost entirely the short-distance riders, a number of whom prefer to walk rather than pay the higher rate of fare. Where a line operates over steep grades, the proportion who walk is apparently smaller than where the line is comparatively level. Another marked tendency is that the heavy reduction in riding occurs within the first few months after the new rate becomes effective. When the public becomes accustomed to a higher rate, local prejudice gradually disappears and the number of passengers carried progressively becomes more nearly normal. This important fact shows the unfairness of any experimental application of the 6-cent fare, based upon a few months of time. At least one year is necessary to reach a normal basis.

Auxiliary Electric Heat

We are advised that Mr. Thomas H. McCauley, general manager of the Calgary Municipal Railway system, is making arrangements to install electric heaters in the cars for use during early-morning and evening hours in the spring and fall. The original heating system will be retained and both systems will be used in the extreme cold weather.

Improving Lake Shore Road

A complete survey is being made by Engineer Johnson and Superintendent Deady of the Toronto and York Radial line along the lake shore, Toronto, with a view to extensive improvements. It is stated that some change will be made in the arrangement for power supply—either moving the present plant at the Humber River to New Toronto or the establishment of a plant at Port Credit, as there is not sufficient power to operate the cars efficiently at the western end of the line. Three new cars are being placed in operation, and the new comfort station at the junction of King and Queen Streets, Toronto, will shortly be opened to the public.

Toronto Railway Company Accepts Award

The Toronto Railway Company have accepted the award of the conciliation board to grant an increase of 7 cents an hour to their men. The men originally went on strike for 10 cents an hour increase, but returned to work with an increase of 6 cents, pending the decision of the board.

Obituary

Mr. Martin N. Todd, president of the G. P. and H. Railway, and general manager of the L. E. and N. Railway, died recently at his home in Galt.

The Dealer and Contractor

Does Your Show Window Bring You Business? —Further Hints on the Proper Use of this Most Valuable Sales Agent

The window compartment should be divided from the rest of the store by a partition or background, of at least such height that neither an observer on the sidewalk nor an employee in the store can see over it.

When the interior lights and display of the store are visible from the sidewalk viewpoint of the window, the attention of people outside is so weakened that very much of the effectiveness of the window display is lost.

It is a very bad plan to allow employees to stand and stare out of the windows—and the best of them **will** do it at times, if window backgrounds are so low as to admit of it.

People hesitate to stop and inspect a window display if they have that feeling of being watched. It has often been noted that having stopped, glancing up and finding out they are watched, people have quickly moved on. Even the strongest minded persons will not look with that same attention, or study the exhibit, as they otherwise would. You know this from your own experience.

For these two strong foregoing reasons, window backgrounds should not be transparent. They may be translucent, of ground or frosted glass if absolutely necessary, for light immediately behind the window back; but this tends to distraction by interior lighting showing through, as explained before.

The background serves to make the display stand out and gives an opportunity to properly illuminate the window because a full light effect can be concentrated on the goods shown. It need not be of mahogany or other expensive wood. In many cases composition board will do very well. This is usually a wood-veneer with an outer layer of mahogany, oak or other hard wood and a backing of roofing paper; other kinds are made from wood pulp. This board comes in pieces eight feet or more long and four feet wide; is light in weight and takes paint readily.

Finishing Your Background

A plush or other hanging can be used instead of permanent construction, but a background of this kind is likely to be dust laden most of the time.

There are many ways to finish the job—paint, stain or varnish; either glossy, semi-gloss or dull. There are also many inexpensive ready-mixed wall colors like alabastine or the kalsomine order, easily mixed with water but which dry quickly and do not rub off. Color schemes can be solid or contrasting but should preferably be tints or of the lighter shades. If of the "wall color" kind they can be changed often with little trouble and expense.

A background that serves very well, may be made by constructing a frame of ¾-inch lumber, four inches wide, mitered at corners.

This should be made six feet six inches high and divided into panels from 30 to 36 inches wide. The latter can be filled with composition board or felt. This comes 72 inches wide at a cost of $1.25 to $1.50 per yard. A good color scheme is a frame of light gray with the panels in darker tone of the gray.

Five to six feet from the window glass to background is a good depth.

The Window Floor

The floor of the window is deserving of much thought and care, for it will do much to enhance or detract from the appearance of the merchandise shown. A hardwood floor of oak with a parquetry border, polished or hard oil finished, is the best for all purposes. It is easy to keep clean, and with care will look well for years. Frequently a dark green carpet is used with a parquetry border. Linoleum may be had in parquetry patterns and when shellaced or varnished serves very well.

In the rear portion of every window electric base receptacles should be inserted in the floor to provide connections for the various appliances that are to be shown in operation. In the ceiling permanent outlets should be provided for hanging lighting fixtures.

The Window at Night

The value of a show window is increased greatly at night by two important conditions:

(1) The mind of the observer is freer at night than during the hustle and bustle of the business day, and so more sensitive to impression.

(2) The drawing power of the display is greater because of the greater contrast between the bright window and its darker environs.

Therefore, it is of first importance to properly illuminate the display.

The light sources should be at the top and front of the window and completely concealed. Lamps should be placed so that the light cannot enter the eye direct from the luminous center. The pupil of the eye adjusts itself to the brightest spot in the range of vision, and if contracted on account of the lamps being in sight, the goods are necessarily less visible and the selling power of the display greatly lessened.

Don't deceive yourself by failing to realize the number of people who see your show windows at night. During the day the passer-by may not have time to give your window more than a passing glance. At night only the bright spots are points of interest and he has more time and will study your display critically. Merchants say that they have watched this matter closely and have frequently seen men and women who were "window shopping" the night before, in the store and buying the next day. Try it yourself and you will be convinced that your window should be properly illuminated at night.

Fixtures and Decorative Materials

The display man can do very little without proper window equipment. In order to do his work effectively, certain accessories are necessary. He must have fixtures and decorative material to draw upon. Metal and wood fixtures, suitable for every display need, can be purchased at a very reasonable cost from manufacturers who specialize in them.

Among these, probably the most necessary are pedestals. These are used to support shelves upon which the electrical appliances are arranged. By using such pedestals a display can be built high in some parts and low in others and thus do away with the flat, uninviting look that is very often noticeable.

Pedestals are made from hard wood, finished to match any desired color scheme. The finish generally used is either mahogany or oak. Pedestals come in sizes ranging as follows, 12 in., 18 in., 24 in., 30 in., 36 in. high in round or square types and from $1 each upward.

Card holders on stands cost from 75c., holding card 3½ in. x 5½ in., to $2.50 holding a half-sheet card 14 in. x 22 in.

Shirt easels serve very well for card holders and can be bought for $1 each.

Plate glass shelves may be had in all sizes from 6 ins. square to 24 ins. wide and 60 ins. long. Circles range from 6 in. to 24 in. in diameter, the cost ranging from a little more than 1c. per square inch in the smaller sizes downward as the size of the shelf increases.

Velvets and velours range from 18 in. to 36 in. in width, and the prices from $1.25 upward. It is advisable to pay a higher price and obtain a quality that will not fade quickly. A few yards of velour, sateen and colored papers can be used over and over to brighten up the display, if fast colors are used.

Store Your Materials Carefully

A small room should be provided for the storing of the window properties when they are not in use. This will save much time and keep the materials in much better shape than is possible when no special place is provided.

There are many little incidentals that should be provided. While all expenses should be kept down to a reasonable basis, it is inadvisable to allow too small an amount for the display department. The windows are likely to lose in selling value, far more than the dealer will gain by his saving. An extra dollar or two spent on a display may often be the means of turning a mediocre window into an attractive sales producer. Take the time to figure out the cost of your windows per year. Charge up everything you can think of and you are still spending on that valuable window space considerably less than on a cheap clerk. And, yet, Mr. Window sells for you many times over what many clerks in your employ can turn in in sales.

The display work in every retail store should be placed in charge of someone who has had an aptitude for that kind of work. He should be allowed wide latitude to work out his ideas, and be given sufficient time to put in the displays during day-time.

The small dealer (or the dealer in a small town) is, of course, handicapped in making the best use of his windows, because he cannot afford to hire a regular display man. Any merchant can, however, have attractive displays if he will allow one of his clerks to spend some time and a little money in making them. The time and thought given to this work is much more important than the expenditure of money, as excellent settings can be made at a very small cost.

Change Your Windows Often

A window, no matter how good, should never remain exactly the same for more than a week at a time, and it is much better to change twice a week. If people become accustomed to seeing the same display in your windows for days (and worse, for weeks) at a time, they will not form the habit of glancing that way when passing; but if you frequently change the appearance of your windows and show something new and attractive real often, the passing throng will make it a part of their daily life to watch and see what you will spring on them next. Then will your windows, filled with seasonable goods, attractively displayed and properly priced, begin to repay you for the effort.

To display merchandise is not merely to scatter articles about in a half-hearted way, but to show them as if you were talking to the customer. Merchandise displays even of the plain everyday kind demand thought in order to get the right idea before the eyes of the prospective buyer.

Every display must be different; the cards worded differently and arranged in a new way. Often you pass windows that, though they have been changed the same day, look precisely the same as before. These soon cease to attract the eye. A sameness in displays makes them dull and uninteresting, with a consequent loss of pulling power. Remember, what we see constantly we cease to see strikingly. The faces we notice the least are those we know the best.

Make Changes During Mornings

In most cities a display does more selling in one hour at night than in three or four in the day-time, so the display should be changed during the hours in which it is least effective. The morning is the best time in which to make the changes. A regular time should be set aside each week, a schedule planned ahead and a set arrangement adhered to.

Essentials of a Vacuum Cleaner Campaign—A Few Hints to the Contractor that May Mean Dollars to Him

There are wide differences of opinion about conducting a campaign, says the Electrical Review. Some merchandisers don't believe in them at all. But it is generally conceded that they produce good results, and that is enough to recommend them. No set method can succeed everywhere, because conditions are different in many localities. Experience, however, has proved the following points about a campaign.

Store preparations, such as window displays, demonstrating facilities, instructions to salesmen regarding the construction of different makes and sales talks, are necessary. First announcements are made by advertisements in newspapers or other mediums, and these followed up during the campaign. Central stations make announcements with the monthly bills.

Announcement of Activities

A prospect list is usually necessary for solicitation. This can readily be made up from lists kept by some dealers and central stations. If no list is available, the names may be weeded out of the telephone directory. Then a signed personal letter with good selling arguments, is sent to those on the list, together with a return card to be mailed back if the recipient is interested. This method brings returns of one to ten per cent.—enough for the solicitors to get started on. Besides, it serves as a good announcement of the store's activities and will bring some customers to the store. With the outside salesmen started, they can increase the number of prospects by making inquiries at the homes when demonstrations are given. After a sale is made, prompt delivery is very desirable and appreciated. It is a good plan to be sure the customer fully knows how to use the device, and it creates an effective impression to make personal calls or telephone calls for this purpose. Keeping a customer satisfied makes another salesman.

These plans and their variations have been tried again and again, and the results have not been so much a measure of the success of the plans as they have been of the enthusiasm of the organization using them. Concrete suggestions gained from successful campaigns serve to show the road to the retailer who contemplates taking advantage of the opportunity the season affords.

Suggestions from Successful Campaigns

While a vacuum-cleaner campaign must, in the final analysis, be planned with particular reference to local conditions, there are many invaluable suggestions that can be gleaned from a perusal of a few of the more noteworthy efforts that have demonstrated their merit. In Chicago, for instance, a campaign conducted last year demonstrated that a crew of men working together under a manager obtained much better results than when individual salesmen were assigned to separate territories.

The crew idea was considered to be better than the individual-man scheme, because loafers, if any, could thus be weeded out of a crew in two or three days, while with the other plan it is generally necessary to give each man at least two weeks to prove his worth. It was the aim of the Commonwealth Edison Company in this campaign to cover the entire residential section of the city, excepting those exclusive homes in which salesmen probably could not secure an audience with the lady of the house. Apartment dwellers and moderately well-to-do home owners were considered the best prospects.

Although the men employed were all experienced salesmen, a factory man was called in before the campaign was started to give a demonstration before the group and to show how the cleaner was made. It was also decided in the beginning to adopt the "first-payment" plan, rather than the ten-day free-trial plan, because women who have no intention of purchasing will accept a cleaner on ten days' free trial, clean the entire house with it and return it at the end of the trial period. When, however, the women are asked, as they were in this campaign, to pay $2.50, or ten per cent. of the purchase price, in cash, and the balance in eleven monthly installments with electric light bills, they regard the transaction as a concluded sale when part of the money is paid. There are no come-backs. Few women will pay $2.50 to have their homes cleaned once or twice. The company's arrangement with the salesmen was that they were to be paid on a commission basis, receiving $2.50 for each cleaner sold.

Education Keynote of Campaign

After gaining an entrance to each house, the salesman asked permission to show what a cleaner will do, and offered to clean any rug or carpet in the house without charge or obligation. To make the demonstration effective, he showed the interior of the bag before and after demonstration. After that, his selling argument began. When a salesman found the prospective customer not at home, he left a postal-card telling of the call and offering to come again and demonstrate the cleaner if the card was filled out and returned to the company. Very few of these cards were returned. On other occasions, when salesmen were unable to complete sales, but believed the people on whom they had called to be prospects, letters were written from the office to follow up the salesmen's effort, and a return card was enclosed. About five per cent. of these cards were returned, and in no case did the salesmen who followed up such requests fail to effect a sale. The difference between the success of the latter type of cards and those mentioned before can be definitely attributed to the fact that the recipient of the latter type had in each case been educated to the advantages of the electric vacuum cleaner, whereas those who received the former cards had not [illegible] demonstration.

The big results of the campaign did not come from the direct sales made by the crew. They were considered the field missionaries. The company's electric shops, however, were the places which cashed in on the field salesmen's efforts, and the campaign was a marked success.

A Plan that Will Work Anywhere

Here is a plan which resulted in the sale of 862 vacuum cleaners. It was carried out in a big city, but a modification of this same plan can be used almost anywhere.

Before a wheel of the campaign machinery was turned, the plan was carefully mapped out. All of the advertising matter was prepared beforehand, the sales and distributing departments were oiled up and keyed to the right pitch of enthusiasm.

The first gun in the advertising campaign was a little sticker leaflet which was pasted to the monthly bills mailed five days before the opening of the sale. This leaflet gave a complete exposition of the terms of the sale, where the cleaner could be seen, and other necessary details. A great many sales were traced directly to the stickers.

On the day the sale opened, the first newspaper advertisement in the leading paper was used in good sized space. All of the local papers were used, but no more than two carried the advertising in any one day. Considerable care was used in selecting the illustrations. One of the objects of the advertising was to sell the "idea" of what the vacuum cleaner would do, rather than the cleaner itself.

Car cards were obtained from the manufacturer and imprinted with the details of the sale. Some billboard advertising was done for general publicity. It costs less than most people think to do billposting. The average expense was one dollar per month per board.

The selling machinery of the campaign worked as follows: Sweepers were not sent out for demonstration, but six girl solicitors covered prospects which each had formulated for herself in advance. To these advance lists were added the names of all prospects developed during the course of the campaign.

Each girl carried a sweeper with her on her rounds. Inside the stores a girl exhibited a machine in actual operation. Her business was not to sell, but to demonstrate; however, she made quite a number of sales. The whole campaign was successful because it was planned—there was no haphazard guess work about it. Once planned, it was carried through to a finish with much greater success than anyone had ever dreamed.

How Much Dirt Does a Vacuum Cleaner Remove?

During America's Electrical Week the New Bedford Gas & Edison Light Company awarded the prize of a $40 suction sweeper to the woman who most correctly estimated the amount of dirt taken from a rug during the week. The actual weight was 5 pounds, 0.75 ounce, the estimate being 5 pounds, 1 ounce.

Free house wiring was awarded as a prize to the man who guessed most accurately the number of holes in a map of the city. The total number was 1,600, and the estimated number 1,565.

Rental-Paid Sweeper Presented to a Customer

An interesting innovation in the rental of vacuum cleaners has been introduced by a central station in a small Middle Western city which commends itself in situations where missionary work is to be done and a bargain feature seems to offer a good influence. To introduce vacuum cleaners, this central station purchased a good cleaner of the sweeper type and advertised it for rent at $1 per day, stating that as soon as the machine had been rented a sufficient number of times, so that the rental income covered the purchase cost of the machine, the sweeper would be presented outright to one of the rental customers. It was explained that this proposition was being offered to give the public an opportunity to try the sweeper and become acquainted with its merits. A list was kept of all consumers who had rented the machine at any time, and when the cost of the sweeper was covered by the rentals, one of these names was chosen by chance and the sweeper presented to this customer with the compliments of the company.

A Vacuum Cleaner for Every Shoe Store

Retail dealers in ladies' fine shoes suffer a loss each year because good shoes that are scratched in the process of "trying on" must be sold at reduced prices. A woman will not pay a high price for a pair of shoes that are scuffed; hence the retail dealers try to keep their heavy carpets and rugs free from sand and grit. Many a merchant thinks he does his best to have the store clean when the "boy" sweeps and dusts the store every day. However, when a shrewd shoe dealer in a middle western city saw the amount of grit and sand which his wife's electric cleaner brought out of his supposedly clean rugs she lost her vacuum cleaner. It was through the merchant's wife that the story leaked out, for when she came to the office of the electrical dealer to buy a second cleaner the salesman was naturally curious to know what had happened to the first one he had sold her. When, later, he called on her husband, he heard a remarkable account of savings in damaged shoes. This good news filled him with so much enthusiasm that he sold a vacuum cleaner to practically every other responsible shoe dealer in the city. The merchants are well pleased with their cleaners and are thanking the electric company's new-business man for the saving he has made for them.

Electric Vacuum Cleaner Used to Remove Carbon in Automobile Engine Cylinders

According to a writer in a recent issue of Scientific American, the household electric vacuum cleaner has been found an effective means of removing carbon from automobile engine cylinders. The procedure with this method is to treat the engine cylinders with alcohol, kerosene, or other agent, to loosen the carbon. This is most effectively done by scraping with a suitable tool. The vacuum cleaner is then connected to the cylinder through a tube nozzle and the carbon quickly removed.

Demonstrations Give 83 Per Cent. Sales

The new business manager for an Ohio electric light company, describes his achievement in selling $16,000 worth of vacuum cleaners, as follows:

"As far as the details of the campaign go, we handled this as we do our ordinary every-day work. The salesmen were simply asked to bend their every effort during the month of March to sell suction sweepers, and in February each representative prepared a mailing list of his prospective customers for these appliances and sent it to the manufacturer, who took care of the personal letter advertising. Beginning February 26th, they sent seven letters a day to each man's territory, and then notified the representatives of the addresses mailed. In this way he could time his call upon the prospective customer the day after the letter was received. This scheme, we found, worked out admirably. We supplemented this advertising with placards in the street cars, with window displays, and with liberal newspaper advertising, from which we obtained very good results.

"After the personal letter had been received, an introductory call was made to obtain permission for a free demonstration and a free two-day trial in the home. After the demonstration and trial, a follow-up call was made to close the prospect, or if this was not possible, to take the cleaner to some other home for a free demonstration and trial. This plan was carried through so effectively that we 'sold' 83 per cent. of our demonstrations, which we think is quite a record."

Every Salesman Should Know His Goods

Try this experiment. Next Thursday night, call your salespeople together and have each one demonstrate before you how they proceed with the sale of vacuum cleaners. You will make this valuable discovery—that if your salespeople knew half of what they ought to know about vacuum cleaners, they would sell seventy-five per cent. more vacuum cleaners than they do.

When one party to an argument knows what he is talking about, there can be no argument. This same theory applies to salesmanship. When a salesman knows what he is talking about, he cannot help convincing the customer and selling him.

Automatic Starters for Induction Motors

Due to the unprecedented demand for manufactured products of every kind, industrial plants in all parts of the country are being taxed to their utmost capacity. In addition, the cost of labor and machinery has been increasing at an extremely rapid rate. The magnitude of these factors has forced manufacturers to employ every means available in an effort to increase production or to reduce operating expenses. This may be accomplished by reducing the numbers of operators, by simplifying the duties of the present operators so that more attention may be devoted to the production of a larger quantity and a higher grade of product, or by furnishing better protection to the apparatus installed, thereby insuring continuity of service.

One of the chief factors by which the desired results may be accomplished is the use of automatic starters and controllers for the motor-driven machinery employed, and the following description has special reference to equipment manufactured by the Westinghouse Electric & Manufacturing Company at East Pittsburgh, Pa. These automatic starters are for use with single phase or polyphase squirrel cage and wound-rotor induction motors, where it is desired to start the motor from a remote point or where automatic acceleration is required to guard against improper starting by unskilled operators. They are simple, reliable, and rugged in construction, consisting of a magnetic contactor panel and a master switch, which may be either a push button, a float switch, a pressure regulator, or similar device for closing the control circuit, depending upon the service. The vital element is the magnetic contactor. The contactors used on these starters are of a type which has been used by the company with marked success in steel mill, cement plant, and mine installations where the requirements are extremely severe. The contactors are opened by strong spring action assisted by gravity. The destructive action of the arc is reduced to a minimum by strong blow-out coils and arcing horns.

The operation of the starters is very simple. When starting motors during line shafting, woodworking and machine tools and similar apparatus, it is only necessary to press a button or close a small knife or snap switch. The starter then automatically makes the proper connections to limit the starting current to a suitable value and to vary the time required for acceleration according to the load on the motor, thus preventing damage to the machinery by to slow or too rapid acceleration, and saving time by bringing the motor to full speed at the most rapid permissible rate. When used for pump or compressor service, in connection with a float switcher pressure gauge, the action of the starters is entirely automatic, the motors being started when the pressure or liquid level of the tank controlled falls to a predetermined point and stopped when the desired maximum pressure or level is reached, or vice versa.

The automatic starters for squirrel cage motors are most frequently employed for starting motors operating centrifugal pumps, air compressors, fans, blowers, metal working and woodworking machines, and other apparatus requiring starting torque less than full load torque. This type of starter, however, owing to the wide application of squirrel cage motors for industrial service, can be applied economically for starting service in nearly every industry.

Squirrel cage motors of 5 horsepower and smaller are usually connected direct to the line. Large squirrel cage motors are first impressed with low voltage from auto transformers or connected to the line through resistance so that in either case the starting current is reduced. When the speed of the motor has reached such a point that the starting current has decreased sufficiently the motor is then automatically connected to the line.

The automatic starters for wound rotor motors are particularly adaptable for starting motors driving plunger pumps, positive pressure blowers, air compressors, long line shafts, and loads having heavy inertia. The severe starting conditions encountered in this class of service require from 100 to 200 per cent. full load torque in starting, making automatic starting a very desirable feature.

When an automatic starter is used in connection with a wound-rotor motor, the line switch is first closed, with the maximum resistance in the rotor circuit. When the speed falls to a predetermined value, a relay closes a magnetic contactor which cuts out a part of the resistance in the rotor circuit. Each contactor operates in a similar manner, cutting out its portion of the resistance at the proper time until all the resistance is short circuited by the last contactor.

The power on any circuit may fail suddenly, and it is important that some protection be afforded both operator and motor against an unforeseen return of power. This protection may be provided for motors operating pumps, compressors, etc., by a low-voltage release to disconnect the motor from the line when the voltage is low or power fails entirely. Then, as soon as power returns, the motor will automatically start up again. In many applications, however, such as for motors operating machine tools or woodworking machines, low voltage protection is required. Motors so protected are disconnected from the line when power fails and will not start when power comes on again until the operator presses a button or manipulates a similar device. Hence, there is no danger from the unexpected starting of a machine.

The advantage resulting from the use of automatic starters for induction motors comprise, absolute protection to both operator and expensive machinery, proper starting at the most rapid permissible rate, economy in operation and maintenance, convenience of remote control, and automatic operation.

Practical Course for Foundrymen

Due to conditions with which industrial managers are only too familiar, there is a great demand for trained foundrymen in responsible positions. Hence at this time opportunities are numerous and attractive for men whose practical knowledge has been consolidated and made readily available by specific training. To insure itself a supply of such men the Westinghouse Electric & Manufacturing Company has recently established a course in foundry work for those of its employees between the ages of 17 and 21 years who have completed at least the eighth grade of public school or its equivalent. The shop course will include the following:—Bench and floor molding; machine molding; core making; tempering of sand; cupola operation; mixing alloys; cost calculating. Classroom instructions will be given during the course on blue print reading, mechanical drawing, shop problems and metallurgy, particular attention being given to the alloys of iron and copper. The idea of the company is to give those desiring it a thorough all-round knowledge of this very important phase of its work.

A Valuable Book for the Investor

The Annual Financial Review, published by Houston's Standard Publications, Stock Exchange Building, 84 Bay Street, Toronto, is just to hand. The Review is a carefully revised summary of facts regarding securities listed on the Montreal and Toronto stock exchanges and including many other prominent Canadian companies. It includes the current annual statements of companies; the highest and lowest prices of stock and bonds on both exchanges for each month for ten years; the number of shares sold each month for the past fifteen months; dividends paid during the past several years, as well as other important items in the history of the different companies, such as increase in capital stock, particulars of franchise, when bonds are redeemable, dividends payable, etc., together with a mass of other facts. It comprises 700 pages of solid information, well printed in a clear and concise manner and nicely bound in full cloth. The work is most valuable, not only to financiers and financial institutions, but to anyone who is interested in setting aside a little pile for a rainy day or for investing safely any surplus which may not be required in his business.

Industrial Heating Offers Wide Field for Electrical Development

More sales possibilities in the rapidly developing field of industrial heating are pointed out graphically in Part 2 of the Society for Electrical Development's new book, "Industrial Heating as a Central Station Load," just issued, and now being distributed to its members. Part 1 of this book dealt almost exclusively with the electric furnace situation, while Part 2 takes up further applications of electric heat, such as arc welding, japanning, annealing, and heat treatment of steel. The need for coal conservation and other economies, makes this whole subject of vital importance to all who use or sell electric current or equipment for such uses as the book outlines.

Besides a discussion of these uses, the book includes a list of classes of applications, their temperature range, lists of heating equipments furnished by various manufacturers, and a bibliography of publications already in existence on the subject. The new book, in its entirety, will be welcomed by manufacturers, central station men, dealers and contractors, wherever there is an opportunity for industrial heating development, as an important addition to their business-getting equipment.

A New Use for Electricity

In a certain United States district there has been found a new use for the vacuum cleaner, which it is expected will open up a new field of work and give the distributers a chance to place several of these machines on the market. The new idea is to use the vacuum cleaner with the blower attachment to drive the bees out of the supers during the honey flow instead of using the old method of smoking them out. The smoke often discolors the honey and in some cases even flavors it. There are a few bee keepers in that locality that the company is going to have try out this method, and if successful they will advertise the fact. The idea, it is believed, can be used in several localities where the bee industry is followed, and its success would soon lead to a general adoption of the practice.

Frames for Switchboards

In designing switchboards for power and lighting stations, the selection of the proper type of frame for supporting the panels is of considerable importance. The size and type of switchboard naturally fix the forms of frame that is most suitable. Switchboard frames built by the large manufacturing companies are of two general classes: those made from structural steel angles, and those made from iron pipe. Angle-iron frames consist of angle-iron uprights supported on a channel-iron base or wood sill and provided with flat top-irons or ties, and the necessary corner angles. The top-iron forms a continuous tie across the switchboard, provides a good alignment for the various panels and also renders bracing each panel to the wall unnecessary. Wall braces are usually made of ¾-inch gas pipe with the necessary end connections for fastening to the frame and to the wall. The panels are bolted directly to the angle irons. This type of frame is best suited for heavy panels and large switchboards.

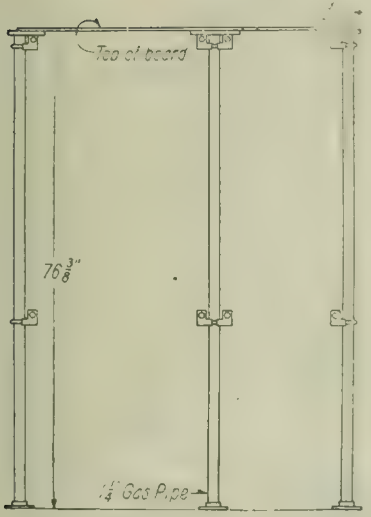


Fig. 3

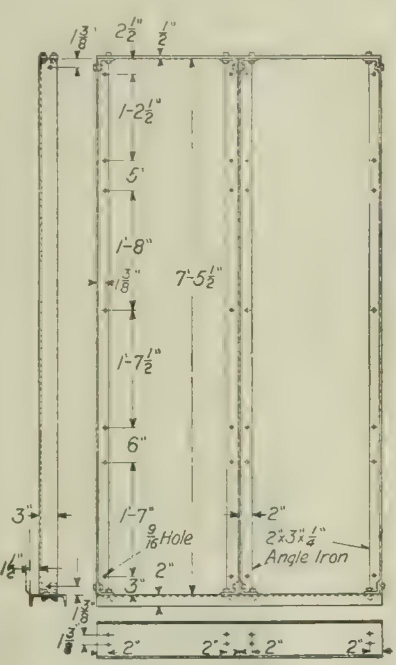


Fig. 1

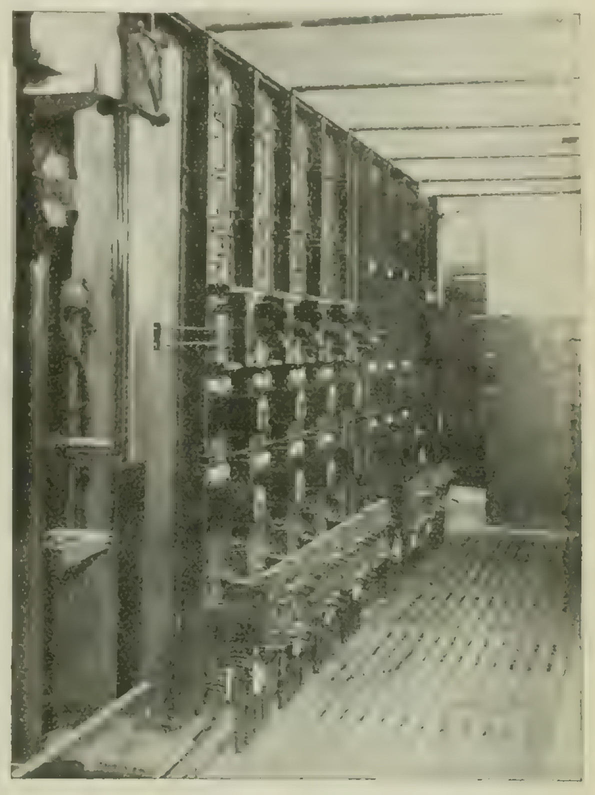


Fig. 2

A typical standard angle-iron frame built of 90-inch panels by the Westinghouse Electric and Manufacturing Company is shown in Fig. 1. This frame includes a channel-iron base, to which the uprights are secured by means of the corner angles and bolts. The chief advantage of this type of frame over any other is that each switchboard panel and its two angle uprights form a unit and may be handled as such in shipping and erecting. The panel may be completely wired by the manufacturer before shipment and the whole shipped to the customer ready for installation. Also any individual panel with its uprights may be removed from a switchboard for relocating without disturbing the connections on the panel. With this type of frame, wiring may be run along the angle uprights instead of directly on the rear of the panel, where such an arrangement is desired. Fig. 2 illustrates this arrangement.

A standard Westinghouse pipe frame is shown in Fig. 3. Pipe frames usually consist of ¾ inch or 1¼ inch wrought-iron pipe uprights resting in floor flanges and provided with top-iron and the necessary top-iron brackets and panel-mounting brackets. The application of this type of frame is limited to light panels and small switchboards. They are especially suitable for supporting panels that do not reach the floor, as, for instance, a 48-inch panel of a 76-inch frame, inasmuch as the pipe uprights make a neat appearance without any covering. When a switchboard consisting of two or more panels is mounted on pipe frames, one upright is common to two adjacent panels, and to pack each panel as a unit for shipment, a temporary upright must be supplied with each panel but one. On account of this additional expense, pipe-frame switchboards are usually shipped unassembled. As compared with angle-iron frames, pipe frames are more expensive (when shipping and erection expense are taken into account) and less convenient, except in the case of small single-panel boards.

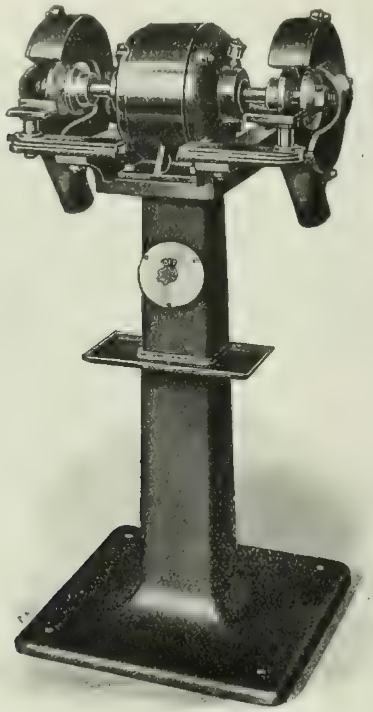
Mr. Jordan is New General Manager

Mr. E. Jordan, Toronto, has been appointed general manager and chief engineer of L'Air Liquide Society, Maisonneuve, with branches throughout Canada. Mr. Jordan, who succeeds Mr. C. Royer, recently come to this country from France, but had previously visited Canada in connection with the company's business. The company have lately extended their operations. A new plant, of concrete, is being erected at Halifax, being a duplicate of the one at Winnipeg. This is exclusively for the manufacture of oxygen and dissolved acetylene. An extension is also being made to the Toronto factory, this addition being a two-storey brick building intended for the manufacture of acetylene cylinders, cutting and welding tools. A further addition has been made to the Maisonneuve factory for the purpose of increasing facilities for the manufacture of oxygen.

The electric range is surely a utilitarian equipment, as the following quotation from a local newspaper will testify:—"Mrs. Frank J. Kerns used her automatic electric range to hatch chickens last week. Old mother hen refused to set longer on the eggs on account of the extreme hot weather. Mrs. Kerns immediately transferred the eggs from the nest to the oven on her electric range and to her surprise the next morning she had 14 little chicks. All are alive and doing well."

New Electric-Driven Grinder

A new line of electric-driven grinders and buffing lathes has recently been developed by the Webster and Perks Tool Company, Springfield, Ohio. The grinders are provided with high pedestals for floor mounting. The smaller sizes have a shelf on the pedestal for tools, while the larger sizes have a door in the pedestal and the interior of the pedestal provides a large compartment for tools. Heavy guards cover the grinding wheels. They are provided with connections for dust exhausting systems. The motors are fully enclosed and equipped with ball bearings. Outboard bearings are also provided on the large grinders. In the smallest size grinders a 1 horse-power motor is used and a 5 horse-power motor is used on the largest grinders. The motors are made by the Robbins & Myers Company, Springfield, Ohio. In addition to the direct connected electrical outfits, the company makes a complete line of belted outfits for all services.



Laurentide's Large Output

It is officially stated that the Laurentide Power Company, Grand'Mere, is now selling 65,000 h.p., of which the Shawinigan Water & Power Company is taking 40,000 h.p., and the Laurentide Company, Limited, 25,000 h.p. Next year the former company will take 50,000 h.p. It is also expected that certain industries in Shawinigan and Three Rivers will take additional power. The plant has a capacity of 120,000 h.p., and this will be reached when the storage dam on the St. Maurice is completed.

Personals

Mr. T. C. Duncan, formerly electrical superintendent of Prince Rupert, B.C., and more recently a consulting electrical and mechanical engineer in that city, has returned to the employ of the city of Prince Rupert as superintendent of utilities.

Lieut. S. L. Haskell, of Lachine, P.Q., reported wounded, is an electrical engineer, who graduated from McGill University in 1907. He was in the employ of the Bell Telephone Company, Montreal, at the outbreak of the war; and received a commission in the artillery unit raised by Lieut.-Col. Creelman. He was later transferred to another artillery unit.

New Books

Practical Electric Illumination, by Terrell Croft, consulting electrical engineer; McGraw-Hill Book Co., Inc., New York, publishers; price $2.00; 212 pages, well illustrated; size 5 x 8 ins.; bound in green cloth. Considerable space is given over in the first sections of this book to a discussion of the principal characteristics of light—what it really is, how it is probably produced, how propagated, how and why it is reflected under certain conditions; how it acts on the human eye, thereby enabling us to see things. Later the quantitative ideas of illumination have been developed. Finally, the remainder of the book is given over to a treatment of actual illumination problems—the lighting of indoor and outdoor areas—and their solution. The chapter headings are as follows: Fundamental ideas of light radiations; principles and units; reflectors; incandescent lamps; arc lamps; Nernst, mercury-vapor and tube lamps; principles of illumination design; interior illumination; exterior illumination.

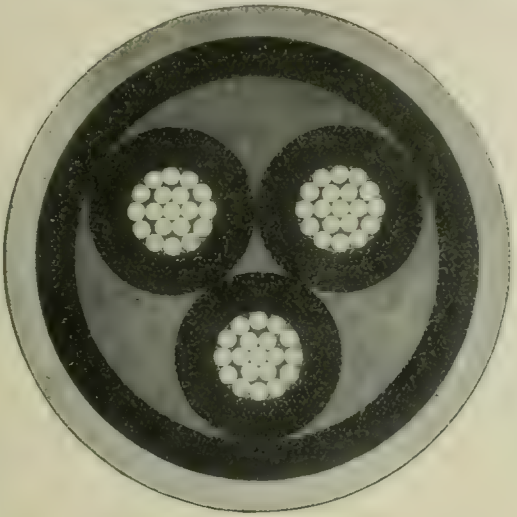
Electric Vehicle Appreciated in Siam

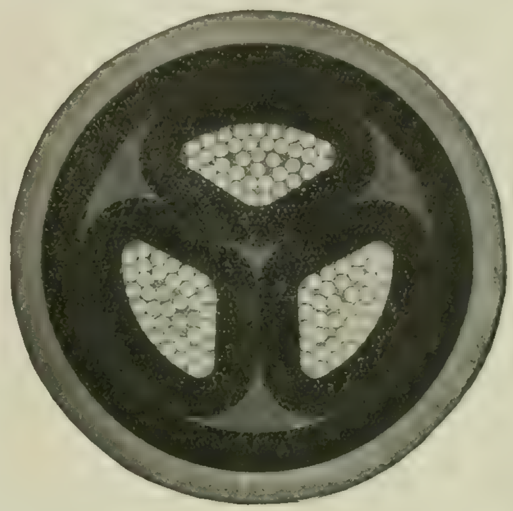
Mr. J. L. Hansen, of the Siam Electricity Company, of Bangkok, Siam, on a recent visit to this continent, advised the National Electric Light Association that his company has a fleet of five electric vehicles, two of which have been in use since 1904. These thirteen-year old veterans are used for lamp delivery, while the larger trucks are used by wiremen, and for various other uses of the company. These electric vehicles are successfully operated by unskilled natives, and are found to be as economical a means of transportation in Siam as they are in this country. This Siamese electricity supply company is especially interesting, since it is not dependent on the fuel which is obtained at such a premium in this country at the present time. This company uses rice husks in place of coal, and this unusual fuel is obtainable in almost unlimited quantities at a small cost. In the event that there should be a shortage of rice husks, the company keep an oil tank for reserve fuel, but it is rarely needed.

Lieut. H. W. Morris, former chief electrical engineer of the car shops of the Grand Trunk Railway, Pt. St. Charles, has been killed in action. He was one of the first to enlist and was given a commission on the field, being transferred to a Highland Battalion recruited in Montreal. Lieut. Morris was awarded the Military Cross on the 12th of last June for conspicuous bravery at La Coullotte. Four of his brothers also enlisted.

PHILLIP'S CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver

Phillips Factory at Montreal

Current News and Notes

Brantford, Ont.

The finishing touches are being placed on a memorial in Brantford, Ont., to Alexander Graham Bell. It is a splendid structure of stone and bronze. Part of the inscription will read: "To commemmorate the invention of the telephone by Alexander Graham Bell, in Brantford, in 1874."

Brussels, Ont.

The plant of the Brussels Electric Light Company was sold by auction on August 14.

Chatham, Ont.

Walter D. Stanbridge, assistant operator at the Kent substation, died recently as a result of injuries sustained by accidentally coming into contact with wires carrying 26,000 volts.

Edmonon, Alta.

The employees of the Municipal Street Railway, Edmonton, Alta., recently went on strike for a 20 per cent. increase in salary. A 10 per cent. offer by the company was refused.

Fredericton, N.B.

The St. John and Quebec Railway Company, Fredericton, N.B., recently called tenders for the erection of station houses and outhouses between Gagetown and Westfield, N.B.

Hartney, Man.

Tenders were received at Hartney, Man., for electric meters, transformers, wire, generators, switchboard, and an oil engine.

London, Ont.

The corner-stone of the London Hydro Shop was officially laid on Labor Day by Sir Adam Beck.

Lumsden, Sask.

A by-law was submitted on September 13 authorizing the issue of $7,000 debentures for purchase of private electric light and power plant.

Melita, Man.

A by-law is to be submitted to the ratepayers of Melita, Man., on September 15, authorizing an expenditure of $10,000 for a street lighting system.

Moorefield, Ont.

The ratepayers of Moorefield, Ont., recently carried a by-law authorizing an agreement with the Hydro-Electric Power Commission of Ontario. Tenders for equipment will be called shortly.

Nelson, B.C.

Lindsley Brothers, Nelson, B.C., have despatched a gang of 25 men to the Arrow Lakes, near Nakusp, to cut timber for poles for the Hydro-Electric System, Toronto.

North Sydney, C.B.

Charles Dixon, a lineman employed by the Cape Breton Electric Company, North Sydney, C.B., was electrocuted recently by coming into contact with a 2,200-volt wire.

Picton, Ont.

The hydro by-laws recently voted on by the municipalities of Picton, Wellington, and Bloomfield, Ont., were carried by a large majority.

Portage la Prairie, Man.

The City Council of Portage la Prairie, Man., are contemplating the installation of a boiler and mechanical stokers in the municipal electric plant.

Regina, Sask.

The Regina Municipal Railway Company contemplate changing to a straight five-cent fare in view of increased operating costs.

Renfrew, Ont.

The sale of the Renfrew Power Company's debentures has been completed. The price obtained was 98½ and the total amount received $99,000.

Sherbrooke, Que.

With a view of bringing prominently before the farmers the use and economy of electricity on the farm, the Southern Canada Power Company had exhibits at the Sherbrooke and Ayer's Cliff fairs. The exhibits consisted of various electrical apparatus designed to show how electricity can be employed in milking cows, pumping, separating cream, sawing, etc.

Smith's Falls, Ont.

The ratepayers of Smith's Falls, Ont., recently passed a by-law authorizing the purchase of the Smith's Falls Electric Power Company and the Citizens' Electric Power Company for the sum of $135,000.

Tilbury, Ont.

By an almost unanimous vote the ratepayers of Tilbury, Ont., carried a by-law to grant certain concessions to the Hessco Electric Company. The town will furnish a free site of five acres, will allow exemption from all taxes, except school and local improvements, for ten years, will furnish free water for ten years, and will guarantee the company's bonds for $35,000 for fifteen years.

Thorold, Ont.

At a special meeting of the Thorold, Ont., Town Council, held recently, an engineer of the Hydro-Electric Power Commission of Ontario explained the advantages of taking power from the hydro line.

Toronto, Ont.

The total receipts of the Toronto Street Railway Company for the year ended August 31 were $6,029,559, of which the city's share was $945,911. The agreement calls for 8 per cent. on the first millon dollars and a sliding scale of 10, 12, 15, and 20 per cent., the latter percentage being on all receipts over $3,000,000.

Vancouver, B.C.

Losses of $199,606 on the Vancouver city lines, $101,095 on the Vancouver-Central Park-New Westminster lines, $98,382 on the Lulu Island line, $16,302 on the Vancouver-Burnaby Lake-New Westminster line, $31,664 on North Vancouver lines, $19,759 on the Fraser Valley line, and $27,894 on the South Vancouver line were shown in statements showing one year's losses given to Commissioner Shortt by Mr. George Kidd, general manager of the British Columbia Electric. The loss, including other minor losses, amounted to $582,316 for the year ending June 30, 1917. With individual power and light profits, the total loss was $384,691. However, the earnings on power, light, and gas on the whole lower mainland were sufficient to counterbalance this, leaving a net profit on the year's operation of $537,801.

The British Columbia Telephone Company are planning considerable extensions to their system, taking in Huntingdon and the Sumas district.

Wallaceburg, Ont.

Plans are being prepared for a new hydro sub-station at Wallaceburg, Ont. The building will be of pressed brick, one storey high. Three transformers will be required.

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Generation, Transmission and Application of Electricity

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Filling the Valleys with Domestic Appliances

A general and unbiased survey of the field of electrical supply seems to indicate beyond the shadow of a doubt that "the electric way" of doing things has taken a firm grip on the public mind. The most discouraging part of the fight has been fought, that is, the absolute indifference of the public has at least been turned to a passive interest, and from now on the customer is ready to be "shown."

It has been an unfortunate fact that the sale of electrical appliances, with the exception of those consuming only a small amount of current, has been handicapped, in that their use has been dependent upon other conditions—sufficiently heavy wiring for the most part—to remedy which has entailed very considerable expense on the part of both the consumer and the supplier of the electric current. This has made it more difficult for the dealer in electrical supplies. Not only has it been necessary to educate the consumer to the purchasing point, but also the dealer has had to convince the central station that this business would be profitable enough to justify the necessary outlay for heavier copper, transformers, etc. In many cases even the generating capacity has reached its limit, and indeed this is a condition in which many municipalities and companies find themselves to-day, particularly in localities where war business has been undertaken.

The sale of electric ranges in particular has been under just such a handicap. It is true that many an otherwise certain purchaser has been held back by the cost of installation within his own house, but it is equally true that the average central station looks upon this load as of somewhat doubtful value, and so is lacking in enthusiasm. Aside from the heavy tax on the existing lines, the cooking load is suspected of coming right on the peak, and in any case it is certain to influence it. In these days, therefore, when load factors are approaching the 100 per cent. mark, due to munition factories running night and day, seven days a week, electric steel furnaces, etc., a short time load is uninteresting. What the central station needs most is a type of load that will fill the valleys of the load curve. So far as the average household is concerned there are only two big things that give any promise of fulfilling the conditions. These are—water heating and regular house heating.

At first sight these two items seem to be on a par, but in fact the first is much more promising. The biggest and first objection to general house heating is that it requires very special wiring both inside and out. The second objection is that it is purely a seasonal load and leaves the central station entirely in the "lurch" during the summer months. Water heating, on the other hand, can be so arranged that it offers neither of the above objections. Take the ideal case where an electric range has already been installed in a home. Then on the supposition that the switching is so arranged that both the range and the water heater cannot be operating at the same time we have the following ideal arrangements:—

1. No extra wiring is necessary, inside or out.
2. It is a long-hour load.
3. It is an all-the-year-round load.

Just to what extent the last two conditions can be approximated to 100 per cent. perfection will depend quite considerably on the method adopted for charging. Such a long-hour, off-peak load plainly deserves a better rate than cooking, for instance. This either entails a separate meter or a flat rate—the latter, of course, insuring the better load factor. With respect to item 3, it may at first appear that water-heating would be merely a summer load, this function being commonly performed by the coal furnace in the winter. The experience of most householders appears to be, however, that a little extra heat in the water tank in winter is never out of place. A possible alternative is to allow the use of this same amount of current for house heating when not required for water heating. The purpose for which current is used is immaterial to the central station and this suggestion would entail a minimum of extra wiring for the consumer.

Everything considered, however, the prospects are very bright for "electrics" in the future. When the war is over this type of load will be, by comparison, more attractive to the central station, there is good evidence of activities in hydro-electric developments and, finally, the supply of anthracite coal from the United States seems to be attended with considerable uncertainty. The near future will probably show a development in the electrical supply business that will entirely overshadow anything we have experienced up to the present time.

Good Lighting Getting Better

In the realm of "good lighting" there have been no startling developments in recent months. Various refinements have been introduced in the manufacture of lamps, reflectors and fittings, but the only item that can strictly be called new is the "daylight" lamp, recently placed on the market. This lamp, however, is of somewhat limited application and so its influence on general illumination problems will not be so greatly felt.

If any other feature is of special mention it is the better realization of the direct value of light in factory work. This has been brought about largely by the heavy demand for munitions which has necessitated production under pressure of every kind. The value of proper illumination has thus been brought forward more prominently and evidence is shown on every hand that the science of good lighting has scored a decided succes in demonstrating its ability not only to increase the quantity, but also to improve the quality, of the product. When the war is over and our industries return to their normal basis of operation it is reasonable that factory managers will continue to profit by the experience thus gained under pressure and that we shall have fewer of those badly lighted work places so prolific in rejected work and expensive and painful accidents.

Street lighting has been more or less at a standstill. Gradually the tungsten is being replaced by the gas-filled lamp, generally of about the same consumption, and some very fine examples of good illumination have resulted at no greater expense than the extra cost of the lamps themselves. Concrete standards are possibly now more popular than metal, due, it may be, to the greatly increased cost of the latter. These, crowned with a single high power light source, are both efficient and handsome in appearance.

Finally, there is the increasing use of flood lighting. Great improvements in reflectors, together with the latest examples of concentrated filament high power lamps, have made this possible and the necessity for protection of munition factories, bridges, etc., has supplied the demand. In the United States, more than in Canada, flood lighting of buildings, statues, etc., has been developed greatly during the past year. In the near future one of its most logical applications will be the use of flood lighting to facilitate construction work.

The Electric Club of Toronto

The first regular luncheon of the Electric Club was held in the Prince George at Friday noon, September 21, Mr. Rogers in the chair. There was no regular speaker for this occasion, the business of the meeting consisting chiefly in the election of officers for the year. The secretary spoke of a number of activities of the organization, particularly regarding the potato farm, which he reported would yield very satisfactory results considering the difficulties with which the Club had had to contend. Particularly we must consider that the efforts had been successful, in that the Club had been a unit in the general movement for that greater production which has resulted in producing a much more plentiful crop of vegetables this year than last, as is already seen in the greatly reduced price of many of these household necessities. Among suggestions offered by the secretary was one to the effect that the present system of wide open election of the chairman for each month should be replaced by one in which three candidates were nominated, the vote to be confined to these nominees. The matter was discussed briefly and referred to the new governing committee for a report, as was also the question of fees. Other matters discussed were the publication of a year book somewhat similar to that of the Canadian Club. The expense involved in such a venture, however, was considered too great to be entertained by the Club at the present time. The governing committee was elected as follows:—K. J. Dunstan, general manager Bell Telephone Co.; H. H. Couzens, general manager, Toronto Hydro-electric System; G. D. Perry, general manager, Great Northwestern Telegraph Co.; W. P. Ostrom, sales manager, Northern Electric Co.; B. O. Salter, chief purchasing agent, Hydro-electric Power Commission of Ontario; W. R. McRae, master mechanic, Toronto Railway Co.; F. T. Jenkins, assistant to the president, Canadian General Electric Co.; Geo. D. Leacock, sales manager, Moloney Co. of Canada; W. R. Carr. Mr. Frank T. Groome was unanimously re-elected secretary of the Club and the new office of assistant secretary and treasurer was very kindly accepted by Mr. C. C. Bothwell, of the Canadian Laco-Phillips Co.

The meeting of the Club held on September 28 was addressed by Rev. Father L. Minnehan, who spoke on "The Irishman Outside of Ireland." The chairman for the month of October is Mr. A. L. Mudge.

Conservation Commission Eighth Annual Report

The Commission of Conservation of Canada have just issued their Eighth Annual Report, being a report of the eighth annual meeting held at Ottawa, January 16 and 17, 1917. The contents of the report may be judged from the following chapter headings: Acting Chairman's address, Hon. Senator W. C. Edwards; Review of the Work of the Commission, Sir Clifford Sifton, K.C.M.G.; The Use of Commercial Fertilizer, H. J. Wheeler, Ph.D., D.Sc.; Fertilizers and their Use in Canada, Frank T. Shutt, M.A., D.Sc.; Memorandum on Soil Tests, Dr. F. B. Linfield; Co-operative Forest Protection, Henry Sorgius; Classification of Crown Lands in New Brunswick, P. Z. Caverhill; Report of Planning and Development Branch, Thomas Adams; The Conservation of a Neglected Source of Food Supply, J. B. Fielding; Fur Resources of Northern Canada, C. Gordon Hewitt, D.Sc.; Production and Preservation of Food Supplies, P. H. Bryce, M.A., M.D.; The Prevalence of Venereal Diseases in Canada, C. K. Clarke, M.D., LL.D., J. J. Mackenzie, B.A., M.B., H. K. Detweiler, M.B., C. H. Hair, M.D., C.M., B. P. Watson, M.D., F.R.C.S., Edin.; Wm. Goldie, M.B.; Our Water-powers and Industrial Development, Leo. G. Denis; Report of the Committee on Forests, Clyde Leavitt; Report of Committee on Lands, F. C. Nunnick; The Water-power Situation in Canada, Arthur V. White; Report of Committee on Waters and Water-powers, Leo. G. Denis; Report of Committee on Fisheries, Game and Fur-bearing Animals, Oliver Master; Problems Relating to the Mineral Industry of Canada, W. J. Dick; Report of Committee on Press and Co-operating Organizations, John Dixon; Reports of Committees—Resolutions; Appendices: Migratory Bird Treaty; Draft Act respecting Trade in Certain Medicines and Appliances; Breeding of Mink in Captivity; Distillation of Coal; Long Sault Development Co.—Opinion of the Supreme Court of the United States; Report of Meeting of Ottawa Civic Improvement League. The report is well illustrated with photographs and maps.

Popular Lecture on Home Lighting

The second of the series of illustrated popular lectures prepared by the Illuminating Engineering Society is now ready for distribution. This lecture answers the question "How shall I light my home." Some forty-five lantern slides accompany the lecture, which covers in detail and in an authoritative manner the specific requirements for home lighting installations, combining the scientific, artistic and psychological principles, but stating these requirements in a non-technical paper of interest to popular audiences. The paper covers some twenty pages of reading matter and paragraphs descriptive of the various lantern slides.

The applications of the fundamentals of home illumination are taken up. First, with respect to the color, quality, intensity and direction of the light from the illuminant; the correct applications of daylight illumination are also considered. Second, the necessary equipments for porches, hallways, reception halls, libraries, dining rooms, bedrooms, parlors, closets, bathrooms, kitchens, basements, laundries, etc., are described and illustrated. Considerable space is given to the functions peculiar to each part of the home and details of the corresponding illumination requirements are described. Third, the fixtures and glassware suitable for home use are covered in paragraphs dealing with diffusion, reflection, absorption, and decorative characteristics of available types. Descriptive lantern slides illustrate these characteristics. This lecture, and the popular lecture on store lighting, maintains a neutral position as regards artificial lighting by electricity or gas.

The lecture, with accompanying lantern slides, may be secured for presentation upon application to the Society, 29 West 39th Street, New York. Reservations should be made considerably in advance of the dates of presentation as only a few sets of the lecture are available at this time. A small service charge covering the cost of upkeep and delivery is made for this lecture, and for a similarly prepared lecture on "Store Lighting."

Canadian Water Powers Described Before A I.E.E., Toronto Branch

The first regular meeting of the Toronto section of the American Institute of Electrical Engineers was held on Friday evening, Sept. 21, in the Engineers' Club. The entertainment was of a quite novel character, being a representation by motion pictures of various water-power developments and electrical distribution systems in the Province of Ontario, principally those controlled by the Hydro-Electric Power Commission of Ontario. The pictures also showed industrial scenes in many of the more prominent Ontario cities, including London, Windsor, Galt, Hamilton, Toronto, Collingwood, Owen Sound, and others. In introducing the picture display, Mr. W. G. Gordon, the chairman of the section, spoke on the importance of water-power development briefly, as follows:

Water-Powers of Canada

One of the most important results of the great war in Europe has been to accentuate the need for economy in every walk in life. This is just as true in engineerng as in any other field, and every natural resource must be conserved to make up for the wastage of war. This is particularly the case with the world's fuel supply. Coal and oil resources are gradually tending towards exhaustion, and it has become a duty on the part of the engineer to substitute other sources of power. Water-power, as present in the great rivers and reservoirs of our Dominion, is inexhaustible; and, while its development frequently demands a large outlay per kilowatt produced, such outlay has the great advantage of helping to conserve the coal and oil supply for the use of the allied navies and for those industries in which the use of such fuel is vital.

One ton of good coal (12,000 heat units per pound) is equivalent to 7,000 kw. hours. In a modern power station, however, utilizing about 16 per cent. of these heat units, a ton of coal yields only 1,100 kw. hours, so that one kw. year is the equivalent of eight tons of coal. It is, therefore, false economy to hold over the development of water-powers till after the war, as any work which will help to conserve our fuel supply is not only desirable but necessary. One of the greatest handicaps which Germany has to face at the present time is her lack of good water-powers, her engineers being forced to use fuel-generated power for their electro-chemical industries.

Among the war industries in which hydro-electric power is an essential factor are the production of nitrogen compounds and cyanamide, aluminum and magnesium, calcium carbide, steel, and copper. All of these are now being produced in Canada, and such processes as these are particularly advantageous for a hydro-electric system on account of the high load factor, as the basis of cheap power is to secure the highest possible ratio of average to maximum load.

The well-being of future generations is linked up with the problem of nitrate production, and fertilizer must be produced to increase the productivity of every acre of land under cultivation. A kw. year of electric energy will produce nearly one ton of fertilizer, and something like 4,000,000 tons per annum is the present consumption of this material.

Probably no country in the world is more fortunate in the extent and location of its white coal than is Canada. Practically every commercial centre from coast to coast, except only a few in the middle prairie provinces, have abundance of water-power available, not only for present needs, but for all anticipated requirements. Indeed, the fortunate location of Canada's water-powers is the outstanding feature of her water-power resources. The Conservation Commission's estimate of Canada's water-power, near population centres, is 17,746,000 horse-power, of which only 1,712,000, or about 10 per cent., is developed. The 17,746,000 horse-power is inclusive in the case of Niagara Falls, Fort Frances, and the St. Mary's River at Sault Ste. Marie of only the development permitted by international treaties, and, further, does not contemplate the full possibilities of storage for the improvement of present capacities. The amount developed of 1,712,000 horse-power is inclusive of all water-powers, whether used for the production of electricity, pulp grinding, milling, and other uses.

Ontario leads in this total, with 789,466 horse-power, Quebec being second, with 520,000 horse power. The power produced on the Canadian side of Niagara Falls totals about 365,000 horse-power.

Were we able to work at 100 per cent. load factor, the total energy in water-power already developed in Canada would represent an equivalent of over 100,000,000 tons of coal per year.

Winnipeg Electric Week Paves the Way for More Sales of Electric Appliances

The Electric Show at the Alhambra, Winnipeg, during the week September 3 to 8, is reported a splendid success. Practically every large electrical concern doing business in the West had apparatus on display, these including: The Winnipeg Municipal Department and the Winnipeg Electric Railway Co.; the Northern Electric Co.; Canadian Westinghouse; Canadian General Electric; McDonald & Willson; Great West Electric; National Electric Heating Co.; Canada Wire & Cable Co.; Canada Dry Cells Co., and others. The value of such a display to these various companies is appreciated when we consider the exceedingly low rates that obtain in the city of Winnipeg, for electric cooking and heating, given by the city light and power department. This is now a straight one-cent per kw·h. rate with a 10 per cent. discount, subject to a net monthly minimum of 50 cents per meter. That the citizens of Winnipeg appreciate this rate is shown by the statement made at the exhibition by an official of the city department that there are already 1200 electric ranges being used in that city and that the campaign is just beginning. The illustration shown is a general view of one corner of the exhibition and shows a number of booths. The committee in charge of the Winnipeg Exhibition are to be congratulated on its success. The names that have been most prominently connected with the work are as follows:—

Chairman General Committee, J. H. Leamy.

Vice-Chairman General Committee, E. H. Smith.

General Secretary and Treasurer, C. T. Kummen.

Promotion and Sale of Space Committee—A. E. Esling (chairman), H. W. Billing, L. R. Baker, R. A. Sara.

Interior Arrangement and Decorations—C. C. Chisholm (chairman), L. B. Dickson, F. E. Filer.

A corner of Winnipeg's Electric Show, held during the week September 3-8, 1917.

Services and Exterior Lighting—E. V. Caton (chairman), G. J. Brown.

Special Features and Entertainments—W. A. Duff (chairman), F. A. Cambridge, G. L. Guy, Chas. F. Gray, L. R. Baker, A. E. Esling.

Finance—R. A. Sara (chairman), H. W. Billing.

Publicity—H. W. Billing (chairman), J. M. Leamy, V. E. Josselyn.

Mailing List—J. G. Smith.

A special feature of the show was a refreshment room in the gallery conducted by the Ladies' Auxiliary of the 223rd Battalion. The proceeds will be used to purchase Christmas presents for the boys in the trenches.

Was This Your Store?

Editor Electrical News

As a reader of the Electrical News, though not in the electrical business, my experience in a recent shopping expedition may be of interest. Wishing to use my pocket flashlight, and finding the battery extinct, I took it down-town to get a new one. In the first store I entered, which claimed to carry a complete line of flashlight accessories, a young woman informed me that the battery was not standard size and they couldn't fit it.

In the second store a male clerk endeavored to attend to my wants. He had a battery all right, and, on question, assured me that the battery **was** standard size. (This I already knew, having purchased many batteries for it previously). However, when the clerk attempted to take out the old battery he found it had become swollen and stuck a little. Being more interested in looking out of the window, he tossed it back across the counter, saying that it would be impossible to get it out, and by his manner showed plainly that the transaction was at an end as far as he was concerned.

"But," I protested, "surely you can make some effort to get it out—there ought to be some way to do it."

"Naw, can't get it out without breaking the case."

"What's a new case worth?"

"Dollar ten."

"Well then, go ahead and get out this battery and if you break the case I'll purchase a new outfit—that's fair enough, isn't it?"

The clerk grunted and proceeded to the rear. After a few minutes he returned bearing the empty case which was not damaged in the slightest.

"Broke my wrist watch doing it, though," he grumbled.

"I'll pay for a new glass in your watch."

"Naw, charge it up to profit and loss."

This represents an actual occurrence and is the kind of service given in some electrical dealers' stores to people who have responded to the national advertising of manufacturers. The sale of a thirty cent battery may not amount to so very much, but the future business lost to the store by this display of indifference might easily represent a considerable amount.

Yours truly, "Flashlight."

Illumination of a Canadian Steel Plant

Many Features Which Assist in Increasing Production—No Glare and Plenty of Light—1000 Watt Gas Filled Lamps

By F. R. Ewart*

The illumination of a large steel plant recently constructed in Ontario presents some rather interesting features. The installation is not startlingly novel, but it furnishes a good example of the application of large nitrogen-filled (Type C) lamps to the lighting of large spaces and from considerable mounting heights. The nature of the work carried on in the plant did not exercise any very drastic influence on the design. The methods used may, therefore, be considered fairly applicable to most industrial buildings of similar dimensions. In the case under consideration, the cost of power, form of contract and nature of load combine to make the cost of current used for lighting extremely low, so that no great economy of wattage was necessary. At the same time, it may be observed from the results detailed hereafter that the economic values attained are quite good.

The three chief areas to be lighted were:

1. Crane Bay (Furnace Room).
2. Transformer Room.
3. Stock Yard.

These will be discussed in order. Considerable lighting was required in addition to the above, but mostly in storage spaces of low head room, which present no features worthy of comment.

Crane Bay.

The main crane bay in which the furnaces are situated is 75 feet wide and runs the full length of the building—607½ feet. The bottom chords of the trusses are 45 feet above the ground. The nature of the work here made a fairly high degree of illumination desirable, ranging from 2 to 3 foot candles. The upper value was aimed at to allow for moderate falling off due to dust on reflectors, etc.

The equipment chosen consists of 27-1000 watt Type C units, mounted on the roof trusses. These trusses are spaced on 22½ ft. centres. Two units are located on every second truss, making the longitudinal spacing 45 ft., while the lateral spacing is 37½ ft. The reflectors used are steel enamel fluted deep bowl type, having a fairly intensive characteristic giving 3400 tip-on candle power. On account of the fact that one large crane leaves practically no clearance between its highest part and the bottom chords of the trusses, the units had to be so mounted that they were entirely above the bottoms of the trusses. To accomplish this purpose mountings were designed as shown in Fig. 1. As an example of fixture design, they must be admitted to be more durable than decorative. Each unit is on a separate circuit and controlled by its own switch in one of the four panel boxes spaced about equi-distantly along the charging floor.

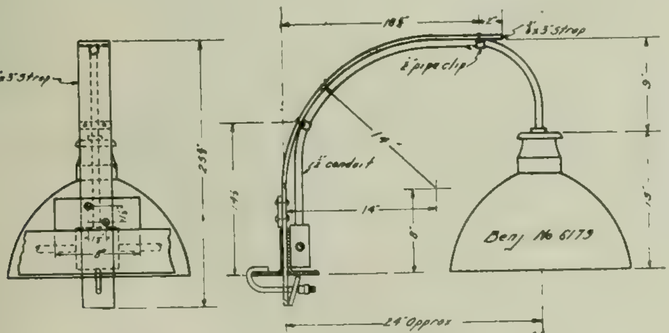

Fig. 1.

The illumination results are shown fairly completely by the curves of Fig. 2. The lower curve shows the distribution of one unit from a point directly below to a distance of 50 feet. The upper curve shows the distribution from one unit to the next when all units in one longitudinal row are lighted. When both rows are in use a considerable overlapping laterally (on shorter centres of 37½ ft.) results in raising the intensity between rows to about 2.8 to 3.1 foot candles. The resulting average over the whole area is approximately 2.8 foot candles. The variations above and below the average are so moderate that an effect of great uniformity is obtained. The wattage per square foot is only .593, or the watts per square foot per foot candle equals .21. The passage of the cranes below the lights casts momentary shadows, but this has not proven objectionable, whereas any attempt to light by wall units below the cranes would inevitably have resulted in most offensive glare.

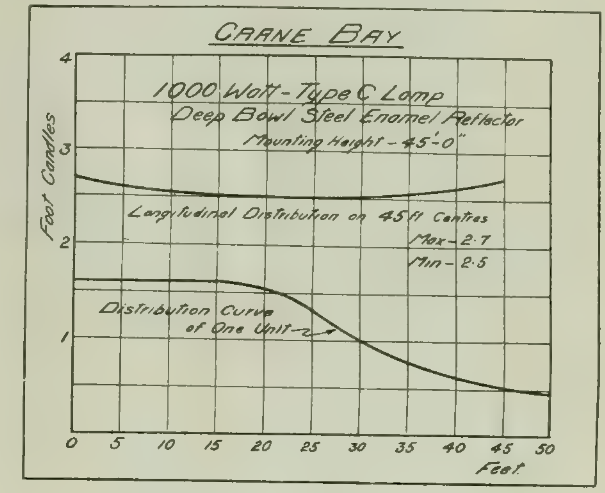

Fig. 2.

Transformer Room

The transformer room, which houses the furnace transformers and all equipment, is 25 ft. wide by 422½ ft. long. The bottom chords of the roof trusses are 15 ft. from the floor. Here an intensity of 2 foot candles or slightly greater was desired.

The high tension bus-work is suspended from the roof trusses so that it would have proved dangerous to install any equipment on the ceiling above. For this reason wall units were used. Two units consisting of 100 watt, type C lamps in steel enamel angle reflectors were installed in each bay on each side, making four units each for 19 bays, or 76 in all. These were mounted on conduit goose-necks, suspending the unit 18 inches from the wall and 15 ft. from the floor. Longitudinal spacing is half the bay length or 11 ft. 3 ins. These units are grouped six on the same side to a circuit, each being controlled from a wall switch every three bays.

On account of the complexity of the distribution in planes at various angles from the plane normal to the wall, the resultant distribution cannot be very clearly represented by ordinary curves. The net result, however, is a fairly uniform intensity averaging about 2.5 foot candles. The wattage per square foot amounts to .71, while the watts per square foot per foot-candle is approximately .28.

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* Ewart & Jacobs, Electrical Engineers.

This arrangement eliminates objectionable shadows from apparatus and has the additional advantage of throwing light on oil switches from the side, thereby revealing their mechanism more clearly. As the ratio of the mounting height to the width of the room is fairly great and the units are not large, no objectionable glare is experienced.

Stock Yard

The stock yard extends along one side of the building for its full length (607½ ft.) and is 75 ft. wide. It is traversed by cranes running on rails 28 ft. above the ground.

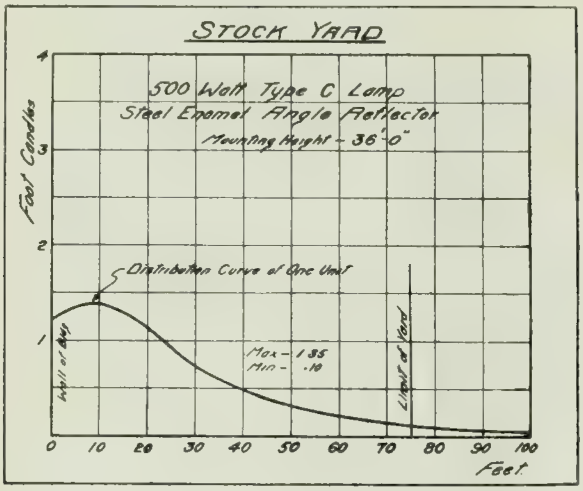


Fig. 3.

The side of the building is 37 ft. high. In every second bay (i.e., 45 ft.) a loading platform projects into the yard under the crane run. Immediately beyond these is the railway siding. The remaining two-thirds of the yard remote from the building is used for storage of raw materials.

The lighting of this area required a moderate intensity over the loading platforms and siding of about 1 foot candle. For the balance of the yard an intensity about equal to good street lighting will suffice (say .1 foot-candle or better).

Fourteen units were installed consisting of 500 watt type C lamps in steel enamel reflectors mounted on conduit goosenecks on the wall of the building, close up under the eaves, giving a mounting height of 36 ft. They were located in the centre of every second bay, alternating with the loading platforms, giving a longitudinal spacing of 45 ft. By placing these units midway between the loading platforms, shadows from the loading hoppers are avoided and the shadows of the platforms themselves is reduced to a minimum.

These units are supplied by a transformer of their own and are controlled altogether by the transformer primary switch on the switchboard in the service room, which has immediate access to the stock yard.

The distribution is shown by the curve in Fig. 3. This shows the distribution from one unit and indicates that the values required have been very nicely complied with. Further calculation shows that the intensity is almost uniform at an intensity of about 1.2 foot-candles for a distance of 25 ft. out from the building, covering the loading platforms and siding. Overlapping of the light from different units increases the intensity of the extreme outer-edge of the yard to about .2 foot-candles. It is obvious that the visibility in this latter region is much greater than that indicated by the real intensity, as visibility is proportionate to the intensity in the direction of the ray. In this section the wattage per square foot is .153 and the average intensity .6 foot candles, giving .25 watts per square foot per foot-candle.

Conclusion

A summary of the results in the three sections is as follows:—

	Crane Bay	Trans. Room	Stock Yard
Total area (sq. ft.)	45,562	10,562	45,562
Total watts	27,000	7,600	7,000
Watts per sq. ft.	.593	.71	.153
Average foot-candles (approx.) ...	2.8	2.5	.6
Watts per sq. ft. per F.C. (App.)	.21	.28	.25

It will be noted that the economic results as indicated in the last line are remarkably uniform in spite of considerable divergence in size of units, mounting heights and required intensities. It would thus appear that these figures are fairly representative of the results which may be obtained with type C lamps under any reasonable conditions of installation.

While it has not been practicable to take photometer readings to check these figures, the appearance to the eye seems to indicate that there has been no great divergence between theory and practice. The lighting appears quite uniform throughout, no objectionable glare is experienced, and the brilliance seems to be all that could be desired.

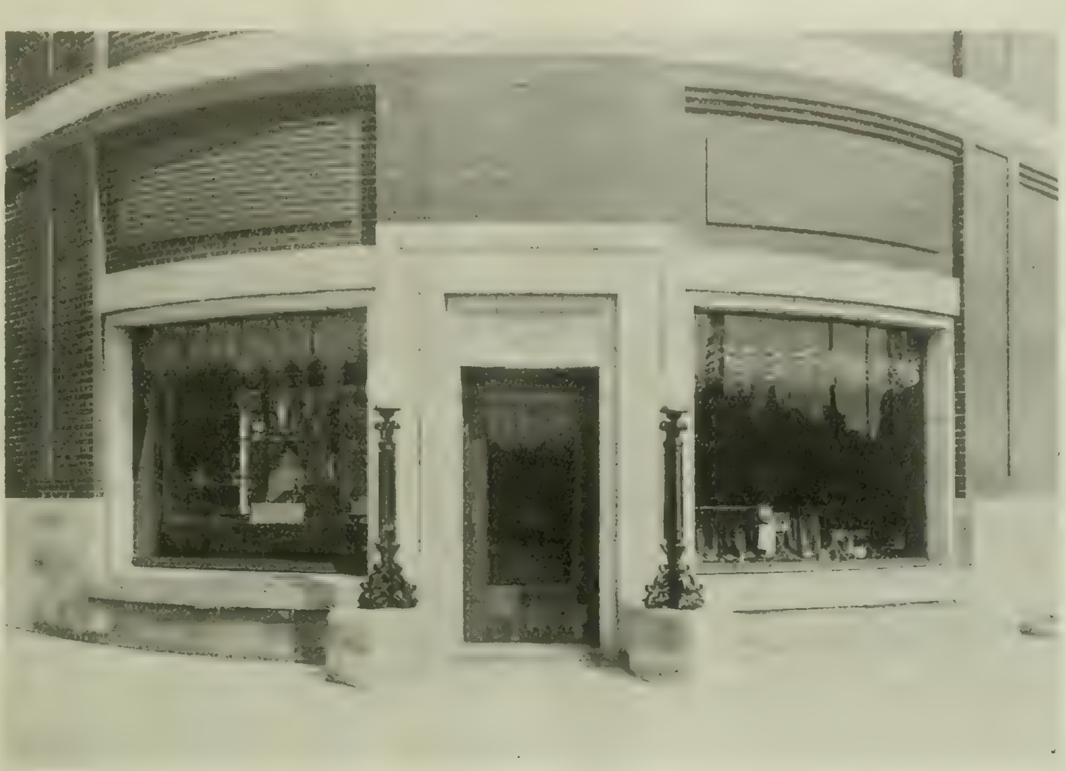
The Value of Location to the Retailer

You Cannot Well Over-estimate It—This, and an Attractive Store Front, the Secret of Many Successes

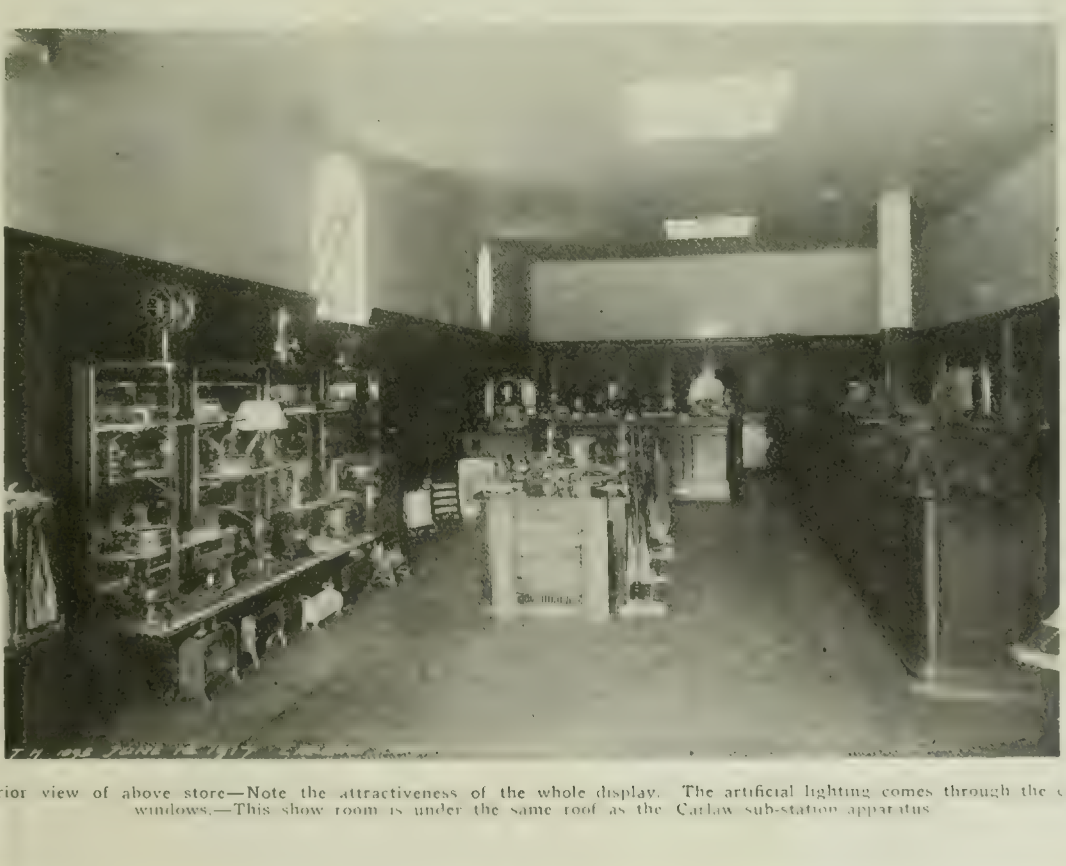
You cannot easily overestimate the value of a good locality and an attractive store front.

The wise man who expressed his opinion to the effect that, "if you make a better mouse-trap than your competitor, it matters not in what obscure corner you locate, the public will search you out and tramp a path to your door," though he expressed a sentiment with which we all sympathize, nevertheless indicated that he had lived in an age and surrounded by an atmosphere into which the knowledge of the powerful influence of advertising had never penetrated. The mousetrap that sells to-day is the one that will, first of all, of course, do the work it is intended for, viz., catch the mouse. But there are so many effective mouse-traps that the public does not go into the fine points of their relative values. Other things being equal, or nearly so, the sale is determined by the extent to which the name of one or other of the makes has become a byword through advertising.

Then there is another unanswerable argument against applying the mouse-trap aphorism to modern electrical merchandising. Mouse-traps are, in general, sought out for purchase because the need has become imperative. Not so with electrical appliances. The first step in the sale of the latter is to interest the customer, the next to convince him of the utility and convenience, and the final one, to satisfy him that the article is of more value to him than the money



A good location and an attractive front—The kind of store a patron feels proud of.—The Carlaw Avenue Branch of the Toronto Hydro-Electric System.



Interior view of above store—Note the attractiveness of the whole display. The artificial lighting comes through the ceiling windows.—This show room is under the same roof as the Carlaw sub-station apparatus he will have to part with to possess it. Such a customer would never follow a path, well beaten or otherwise, to see an article he does not want.

Such, in general, is the difference between ancient and modern merchandising. It is just the difference between "order taking" and "salesmanship." In the olden days, the man behind the counter had no idea what the "wants" of the customer were until he came and stated them. To-day the salesman cares less what the customer's "wants" are, because his greater knowledge of merchandising has taught him what his "needs" are. So it is not nearly so much a matter of selling a customer what he wants as what he ought to want, although, of course, the fine art of salesmanship must take cognizance of human frailties and every effort should be made that the customer may be brought to that state of mind when what he actually wants and what he ought to want are one and the same thing.

However, the main point we would make is that the literary gentleman who conceived this catchy mousetrap idea would have been a lamentable failure as a business man. The path of his poetic imagination would be overgrown with grass and weeds and the doors blockaded with cobwebs. His only alternative would have been to move to the front street, build a fine store window, stack it with mice and traps, and demonstrate to the passers-by that here was the apparatus that was absolutely essential to their comfort and peace of body and mind.

Whatever the cause may be, such is the age in which we live. The live business firms, particularly those with merchandise that may be easily demonstrated, are seeking the main streets and the prominent corners. The window has become as valuable an asset to the merchant as the storeroom, and since the window is the invitation to enter, it follows that the more people there are to see it, the better. There is the educational value of the good show window, too, which saves the salesman many words and lots of valuable time.

Where Most Customers Pass

Briefly stated, then, the best business location is that point where most prospective customers pass by, and the most successful business is, other things being equal, the one that gives the greatest possible amount of information and education through its window display and demonstrations. That these points are generally recognized, there is little doubt. It is common practice, for example, for a business man, looking for the most suitable location, to make an actual count of the number of persons passing the different points at which he is considering locating. Central stations, electrical dealers and contractors have in many cases chosen the location of their shops with the greatest care, but there is ample room for a further extension of this far-sighted policy. We must not consider too closely the immediate outlay in dollars and cents. If it brings good dividends, it becomes an investment in the best sense of the word.

A Resume of Flood Lighting, Its History, Fundamental Theory and Practical Applications

By J. R. McFarlin*

(The historical facts presented in this paper are from an article on "The Evolution of Light Projection," by C. A. B. Halvorson and R. B. Hussey; The Central Station; Vol. 17, No. 1, 1917).

"Flood Lighting" may quite properly be defined as "illumination by projection"; hence in searching into the historical aspects of this branch of illumination one is quite naturally led into a study of the earlier types of lenses and mirrors and the various applications to which they have been adapted. Perhaps no more fertile field obtains than that applying to the use of light for signalling purposes such as are found in lighthouse service.

Projection apparatus consists simply of means for collecting light flux from the luminous source and redirecting and projecting it in the direction desired; this may be accomplished by reflection, by refraction or by a combination of the two; or in other words, by means of mirrors, by means of lenses or by a combination of the two.

Tradition states that when the Romans besieged the city of Syracuse in the year 212 B.C., Archimedes used mirrors to concentrate the rays of the sun and thereby set fire to their ships.

Euclid, the celebrated geometrician, who lived in the third century, B.C., is credited with the authorship of a treatise on optics which takes up among other matter, the reflection of light from concave spherical mirrors and alludes to setting fires by the sun's rays. The names of Claudius Ptolemaeus and the Arabian scientist Alhazen also stand out prominently amongst the early philosophers whose investigations dealt with the reflection and refraction of luminous radiation.

Although many men had investigated the refraction of light, Snell was the first to succeed in establishing the principle and expressing it in the form since known as Snell's Law, which states that the ratio of the sines of the angles of incidence and refraction is a constant for a given medium; this ratio is known as the "index of refraction" of the medium, and a consideration of this factor is of prime importance in the design of any mirror or lens in which refraction of light occurs.

In studying further along these historical lines, we find other interesting developments. From the work of Alhazen in the 11th century and that of Vitellio in the 13th century, came the idea of using spectacles. John Peckham, Archbishop of Canterbury, who died in 1292, mentions the use of mirrors made of steel, iron, polished marble and of glass covered on the back with polished lead. Hevelius, a German astronomer, who died in 1684, invented a lens device for use in war, which he called a polemoscope and which was essentially the same as the trench periscope of today.

Other famous scientists who contributed materially to the theories underlying light projection were Huygens, of Holland, who was the first to express in definite form the wave theory of light and to satisfactorily explain the principles of reflection and refraction; Newton, Dolland, Lavoisier, Fresnel, Mangin, Drummond and many more may be numbered among those who contributed notably to the science of light. Space permits only the mention of their names without touching on their individual contributions.

Spherical Lenses and Mirrors

It is perhaps safe to state that spherical lenses and spherical mirrors were the means first employed for the projection of light. In Fig. 1 is illustrated the action of a simple double convex lens as a light projecting means; in this figure, the lens is represented by A B, while F represents a point source of light located at the focus of the lens; any ray FM upon reaching the surface of the lens suffers refraction at point M where it leaves the air and enters the glass; it traverses the glass in the direction MN, being again refracted at N and emerging from that point in the direction NO parallel to the principal axis. With this simple scheme it is seen how a certain percentage of the light flux from the source is collected by the lens and projected in a parallel beam of high intensity.

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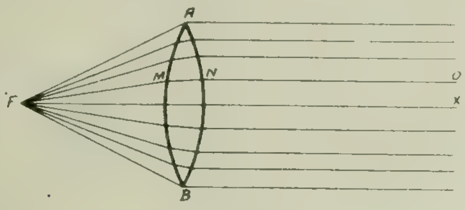
It will be noticed that in connection with Fig. 1, a point source of light is specified. However, as no light source generally employed for illustrative work even approximates this hypothetical point it is well at this time to consider the change introduced when the point is replaced by a light source of finite size. Fig. 2 shows a condition similar to that in Fig. 1, but in which the light source F has finite dimensions; it will now be seen that instead of all rays being projected parallel to the axis, a certain dispersion occurs, this dispersion being dependent on the size of the light source, the focal length of the lens and its diameter. With finite light sources, the projected beam always suffers a certain dispersion, but for purposes of clearness only the point source will be employed in most of the illustrations following.



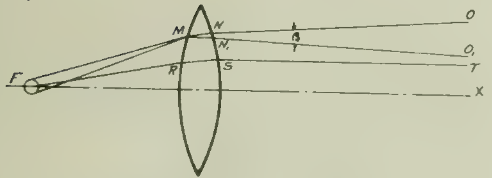


Fig. 1 (above). Fig. 2 (below).

Fig. 3 shows a typical spherical mirror, a silvered metal mirror for example, where reflection takes place from the front surface; the centre of curvature of the mirror is at C. If now a source of light be located at point F, one-half the radius of the mirror, a certain percentage will be intercepted by the mirror and will be reflected and projected as rays MN, ST, substantially parallel to the axis RX. If the source were located at C the reflected ray would take the path shown as BH; if the mirror were entirely free from spherical aberration this reflected ray would cut the centre of curvature C.

Fig. 4 shows a spherical mirror made of glass silvered on the side furthest from the light source. Here it is seen that a ray of light from the source F suffers refraction at M where it enters the glass, is reflected at the silvered surface N and again suffers refraction at point O before finally emerging as a ray substantially parallel to the axis BX.

Both spherical lenses and spherical mirrors are unsatisfactory as light projectors because even with small and highly concentrated light sources the beam dispersion, or the spherical aberration of the lens or mirror, becomes very pronounced when they intercept the light flux from the source in other than a very small solid angle.

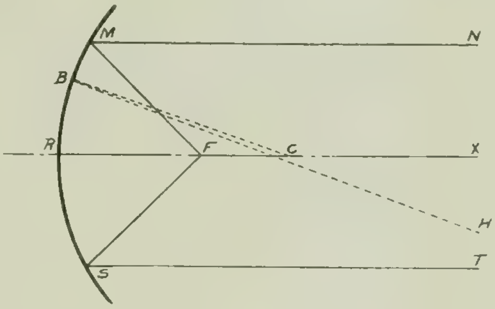
In 1874 Mangin devised a glass reflector in which spherical aberration was almost entirely avoided; this he accomplished by giving the glass the form of a concave-convex lens instead of making it of uniform thickness as had previously been done. A typical Mangin mirror is shown in Fig. 5. With these mirrors it is possible to utilize a much larger percentage of light flux as compared with the ordinary spherical mirror, but where the effective angle subtended by the mirror exceeds, say, 60 degrees, spherical aberration becomes present to a greater and greater extent.

Conic Reflectors

Parabolic, ellipsoidal and hyperbolic reflectors are generally referred to as conic reflectors since they are surfaces of revolution of the corresponding conic curves. In light projections, ellipsoidal and hyperbolic mirrors are seldom used, hence in the following discussion reference will be made only to the parabolic reflector. The parabolic reflector or mirror is one whose surface is generated by the revolution of the arc of a parabola, AM, about its axis AX, Fig. 6. It is a property of a parabola that the right line FM, drawn from the focus F to any point M of the curve, and the line ML, drawn parallel to the axis, make equal angles with the tangent TT′ at this point. If F represents a point source of light located at the focal point of the mirror, and FM represent a ray of light striking the mirror at M, it is evident that the reflected ray ML will be parallel to the axis AX. Similarly any other ray from F which strikes the mirror at any point will be reflected parallel to the axis AX. Hence all rays from the light focus which strike the surface are reflected, parallel to the principal axis, in a uniform beam.

This description covers the theory underlying either a metal parabolic mirror where reflection occurs from the front surface, or a glass parabolic mirror where reflection occurs from the rear surface. Fig. 7 shows how light is reflected in a typical glass parabolic mirror.

As has been mentioned elsewhere, in practice we deal not with point sources of light, but with sources having finite dimensions; hence in practice we get a certain deviation from parallelism of the projected rays; this is called dispersion, and the included angle between rays on opposite sides of the principal axis is called the angle of dispersion.



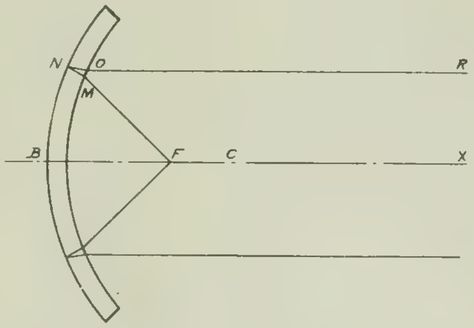


Fig. 3 (above.) Fig. 4 (below).

This is illustrated in Fig. 8. By locating the light source behind of, in, or ahead of the focal point of the mirror we can, to a certain extent, control this angle of dispersion; this is extremely valuable in flood lighting work, for at short range it is evident that we desire a widely dispersed shaft of light while for long range projection minimum dispersion is desirable.

Fig. 7 shows that maximum beam concentration, or minimum angle of dispersion, is secured when the light source is located exactly at the focal point of the mirror.

Fig. 9 shows the effect secured by drawing the filament of the lamp behind the focal point; when the extreme outer edge of the filament is just at the focal point, maximum effective dispersion is secured. If it be drawn further behind the focal point, a dark spot begins to appear in the centre of the beam; this, of course, should be avoided in all flood lighting work.

Fig. 10 shows the effect secured by pushing the filament of the lamp ahead of the focal point; with this condition it is seen that the light rays, instead of diverging from the principal axis, converge towards it, and at a sufficient distance from the projector the rays will cross and after crossing will of course diverge again.

Parabolic mirrors are known to have been used more than a century ago, and their many advantages recognized even before that time; chief of these advantages may be mentioned their efficiency in utilizing a very large percentage of light flux from the source and their comparative freedom from spherical aberration as compared with lenses and spherical mirrors. Their great difficulty, however, was that they were difficult to make. Manufacturing processes have been so vastly improved within recent years that it is possible to secure parabolic mirrors, particularly those made of glass, of great accuracy and at relatively low cost. Hence for all purposes of light projection, including flood-lighting, parabolic mirrors are most generally used.

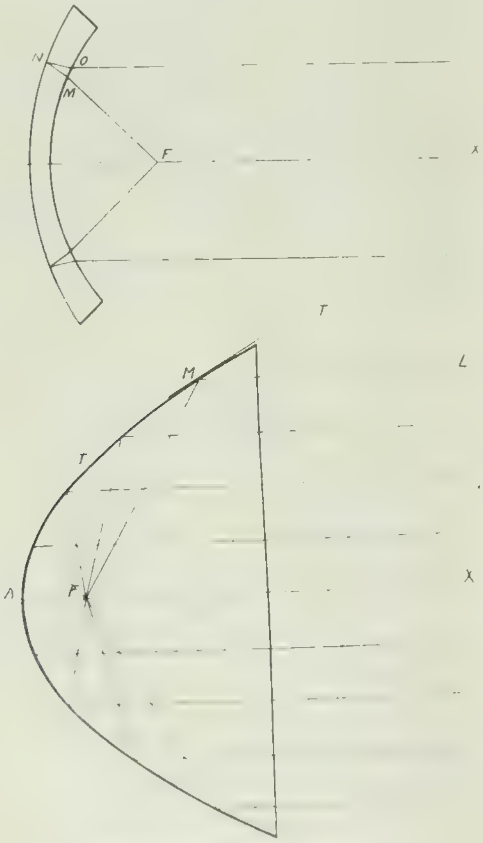


Fig. 5 (above) Fig. 6 (below).

Historical Flood Lighting

It is difficult to trace the history of flood lighting from its first inception, since installations are always local and little comment other than local could be expected from same. On the occasion of a celebration in London in 1872, an attempt was made to illuminate the dome of St. Paul's Cathedral by the use of a large number of ship lanterns but the result was seemingly unsatisfactory. Commenting on this, a London magazine makes the following statement: "Perhaps the most practical way of effectually illuminating St. Paul's would consist in flooding it with electric light projected from various quarters."

Dr. Louis Bell in 1902 suggested flood lighting for such subjects as statues and monuments; in 1906 Mr. W. D'a Ryan conducted experiments along spectacular flood lighting effects, presaging the work later accomplished at the Hudson-Fulton Celebration and the San Francisco Exposition; in 1908 the Singer Tower in New York was flood lighted by means of arc searchlights. All of these installations were, as it were, paving the way for a more general use of this wonderful form of illumination; the principal handicap to its general adoption being in the excessive cost of the flood lighting equipment necessary.

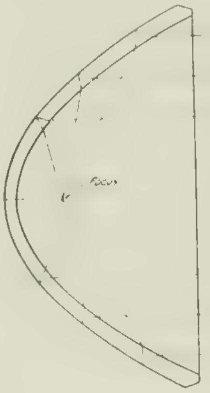


Fig. 7.

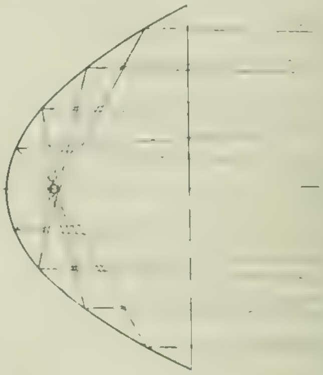


Fig. 8.

Perhaps the greatest factor in placing flood lighting on a thoroughly commercial basis came in the development of the concentrated filament gas-filled type of incandescent lamp. Here was offered a light source of high intensity and small size; one which could be made and sold at a cheap price; and one which was admirably suited for use in a parabolic mirror either of glass or metal. From this point flood lighting grew by leaps and bounds.

Flood Lighting Applications

Roughly, and for purposes of differentiation only, flood lighting may be said to be employed for four purposes:—

(1) Aesthetic; which may be classed as the use of flood lighting to depict and enhance the beauty of objects so illuminated.

(2) Advertising; this borders closely on the above, though, as generally considered, the results to be secured are different.

(3) Pleasure; permitting the enjoyment of various recreations at night quite as fully as during the daytime.

(4) Utilitarian; broadly speaking, the adoption of flood lighting to industrial needs.

To show and to explain briefly the uses to which flood lighting in each of these four classes may be adapted, let us in a few words consider each.

Aesthetic flood lighting appeals at once to the sense of the beautiful; monuments, for example, or interesting places, public buildings, fountains, parks, etc., under their flood of projected light are brought at night into even greater prominence than in the daytime; such lighting is both dignified and effective and lends itself well to a multitude of applications.

Aesthetic flood lighting, aside from its impressiveness from the spectacular point of view, has a definite and valuable business side as well. A city possessing flood lighted objects secures direct and valuable advertising possible by few other means; flood lighting spells progressiveness progressiveness not only for the city and its inhabitants in general, but for the central station and all concerned.

- The advertising value of light has long been recognized; merchants were quick to recognize the advertising possibilities of well-lighted store interiors; this let to beautiful and well-planned window lighting; to exterior lighting of the stores' sidewalks and signs. It was but a step further to the illuminated sign, and with this advent of flood lighting there came the possibilities of projecting light over the exterior of the whole building, as well as onto signs, water tanks, billboards and for various other advertising purposes, where before flood lighting became generally available such lighting was either impracticable because too expensive, or practically impossible owing to the extreme difficulty that would be experienced in carring wiring to the desired location.

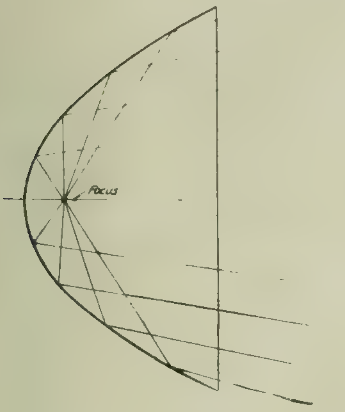


Fig. 9.

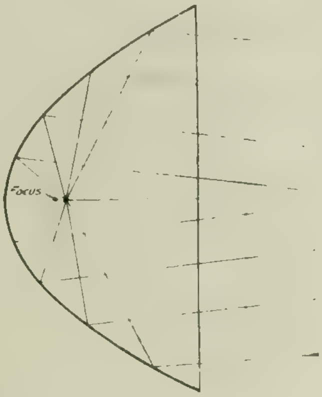


Fig. 10.

For advertising purposes the field of flood lighting is practically unlimited, and owing to its beauty, its effectiveness, its economy and its ability to meet and surmount the most difficult conditions its field may be expected to enormously increase.

To consider the effect which flood lighting has had in enabling thousands of persons to enjoy to the fullest extent pleasures which darkness would otherwise have rendered impossible, one has only to consider the wide adaptation to which flood lights have been placed in illuminating bathing beaches, skating ponds, tennis courts, athletic fields, rifle ranges, gun clubs and much more. Surely in bringing to realization this aspect of life with its beneficial effects on those who otherwise would be deprived to a large extent of such healthful recreation, flood lighting has rendered a benefit to mankind difficult to overestimate.

Then there comes what might be termed the purely utilitarian side of flood lighting, or the use of flood lighting in industrial enterprises. A few such uses may be said to be those connected with construction work which must be pursued by night; the illumination of docks and wharves, arsenals, ammunition plants, fire fighting, linemen's repair wagons, and much more.

Flood lighting for these purposes possess the advantages of low cost, great portability and adaptability; flood lighting installations are simple to install and maintain; so simple in fact that with due observance to a few fundamental rules most anyone is enabled to lay out and install flood lighting installations that will give exactly the results desired. These advantages, in conjunction with the important fact among others, that by its means we are enabled to illuminate objects located at considerable distances from the projector, make it peculiarly attractive for this purpose. In so offering an effective substitute for daylight, flood lighting has added immeasurably to our efficiency as an industrial people

Intensity of Illumination Required for Various Flood Flood Subjects

The intensity of illumination required for various flood lighted subjects depends, to a large extent, on local conditions; much depends on the color of the building and its surroundings when considering the aesthetic side of flood lighting particularly, and these and other conditions greatly affect any proposition which is contemplated. White marble statues, light gray buildings and similar structures require low intensity illumination; freight yards and other industrial requirements where great detail is not required likewise call for low intensities. In other work, such as flood lighting buildings of brick, dark-colored buildings, bronze statues, signs with light background or signs which are situated in fairly well-lighted locations, a high intensity of illumination is required to cause them to stand out prominently. Generally speaking, the general run of flood lighting subjects require illumination varying from ½ to 10-foot candles intensity for satisfactory results, or expressed in other words, from 0.1 to 1 watt per square foot of illuminated surface.

Photometric Characteristics of Flood-Lighting Projectors

Since the intensity of the projected beam from a flood lighting projector varies considerably from the centre towards either end it becomes necessary in making intensity measurements to measure at a number of points across the beam; from these values an average value of intensity may be determined. Such measurements are usually made as shown in Fig. 11. Here O represents the projector; A-B-C represents a circular arc at any convenient distance V from the projector. (This distance V, however, should be large in comparison with the diameter of the projector). This circular arc is divided off into any number of equally spaced subdivisions, usually 1 ft. apart, and at each spot a photometer reading is taken. These readings are usually given in foot candle intensities.

Fig. 12, Curve A, shows the light distribution curnve of a typical flood-lighting projector, equipped with a 400 watt Mazda "C" flood lighting lamp. The horizontal points of the curve show distances in feet either side of the point B of the circular arc A-B-C. Point B is taken as the zero point.

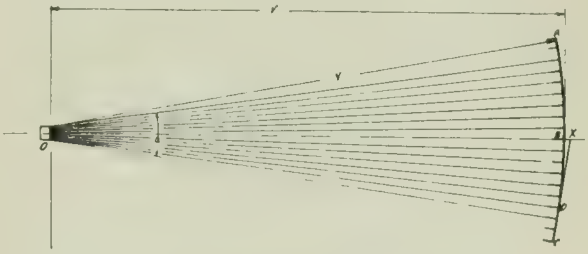


Fig. 11.

Since the diameter of the projector O is negligible in comparison with the distance V it may be assumed that the photometer receives light from every point of the luminous surface of the projector mirror. Hence the projector may be considered as a point source of light, and the foot candle readings taken at the various stations may be converted into beam candle-power by multiplying them by the square of the distance V. At the right hand side of Fig. 12 will be found the values of apparent beam candle power so obtained; the distance V being 100 feet.

These light distribution curves also give us the means of measuring the angular dispersion of the projected beam. In figuring dispersion, it is usually assumed that the usefulness of the projected beam has disappeared when its intensity has fallen to 10 per cent. of maximum. Hence determining this value from our light distribution curve it becomes an easy matter to measure the beam dispersion. This may be determined with sufficient accuracy by taking from the curve the distance from the centre of the beam to the point at which the intensity has fallen to 10 per cent. of maximum and dividing by the distance from the projector to the photometer; this result will be the tangent of one-half the dispersive angle, from which the dispersive angle may be gotten from any table of natural trigonometric functions.

Or again, in figuring dispersion, the distance along the arc A-B-C instead of being measured in feet may be laid off in degrees, whence the dispersion may be read directly from the light distribution curve.

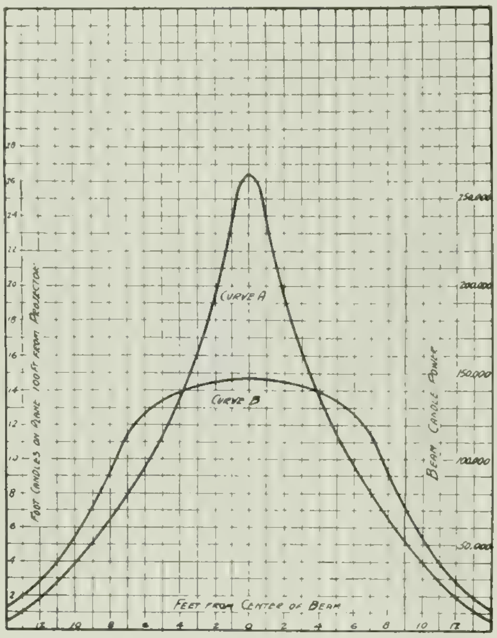


Fig. 12.

Curve B of Fig. 12 shows the effect on light distribution and dispersion when the filament of the lamp is drawn behind the focal point. This flattens out the curve very materially, spreads the beam out and, of course, reduces the average intensity.

It should be mentioned that the maximum beam candle-power of a projector equipped with a given size lamp varies among other things with the concentration of the filament, the greater the concentration the greater the beam candle-power; the dispersion varies also with the concentration and becomes smaller as the filament is more concentrated, greater as the filament increases more and more in size. Hence a direct comparison between different projectors based on beam candle-power alone is sometimes apt to be misleading. The real basis of comparison for the efficiency of any mirror lies in the percentage of total light flux from the bulb which is collected and projected into the beam.

Covering Power

There are only two ways in which light can be thrown onto a subject—either directly at it, or from an angle. The former method may be termed "Circular Projection," since the area illuminated will be circular in shape; the latter may be termed "Elliptical Projection," since the area illuminated will be elliptical in shape. Circular projection is illustrated diagramatically in Fig. 13; elliptical projection is illustrated diagramatically in Fig. 14.

Table A gives the diameter and areas of circularly illuminated areas with beam dispersions of both 12 and 16 degrees. Table B gives the width, length and areas of elliptically illuminated areas with beam dispersions of both 12 and 16 degrees, taking into account the perpendicular distance of the projector from the illuminated surface and the angle which the central ray makes with this perpendicular.

As has been stated, beam dispersion and beam candle-power depend primarily with any given reflector or mirror on the concentration of the filament of the lamp employed. Hence these values as given may be subject to slight variation with variations in the lamp bulbs employed.

To determine the average foot candle intensity of illumination on the lighted area, the simplest method is to average the beam candle-power for the projector used and this value divided by the square of the distance in feet from the projector to the centre of the illuminated surface will give the average foot candle intensity over the illuminated area.

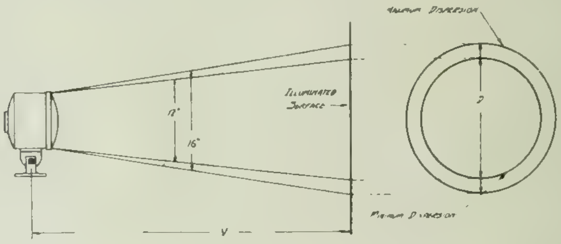
General Rules to be Observed in Flood Lighting Installations

First determine the available location for the flood lighting projectors and the distance and angles from them to the area to be illuminated.

The area is next to be determined, and from this the total wattage necessary to cover same to the desired intensity may be calculated. This total wattage required, divided by the size bulb to be used in the projector (generally 400 watts), gives the number of projectors required.

The projectors will generally have to be located in the most convenient spots; they should, however, always be mounted as accessible as possible as this facilitates the replacing of incandescent bulbs when burned out.

For flood lighting small objects, such as signs, etc., the projectors may be trained directly at the object, thus illuminating a circular area; with any given projector, circular projection illuminates a smaller area with a given beam concentration than is the case with elliptical projection; hence the former will produce a higher intensity of illumination than the latter.



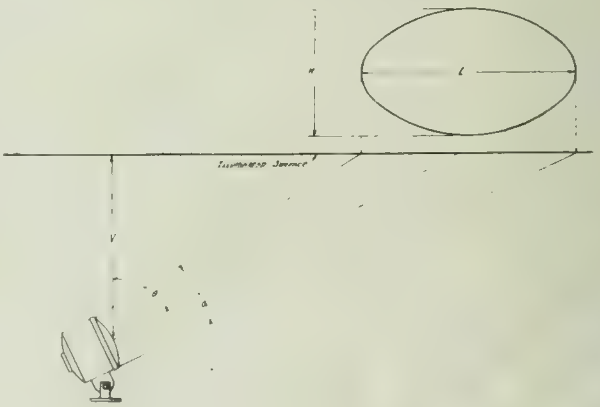


Fig. 13 (above). Fig. 14 (below).

Where circular projection is employed on a larger area, which it is desired to illuminate fairly uniformly, the beams should be so trained that the illuminated areas will considerably overlap. This is important if a uniform illumination free from "spotty" effects is desired.

In the large majority of flood lighting installations it will be found necessary to train the beams toward the surface at an angle. This is generally to be preferred to projecting directly at a surface as it produces a more even illumination and a consequent freedom from spotty effects.

Elliptically projected beams should be so trained that an overlapping of the illuminated areas is produced. This tends still further to uniformity of intensity on the illuminated area as a whole.

In flood lighting subjects requiring more than one projector, always choose two or more locations for their installation. This causes the light to be thrown on the surface from two or more angles and not only tends toward even and uniform illumination, but also minimizes shadows which would occur if the light were projected from one location only. This is one rule which can and should be observed in practically every installation.

Table A—Diameters and Areas of Surfaces Illuminated Employing Circular Projection

	12° Dispersion		16° Dispersion	
	D	Area	D	Area
Feet	Feet	Sq. Feet	Feet	Sq. Feet
50	10.5	87	14.1	155
100	21.0	346	28.1	620
150	31.5	779	42.2	1,395
200	42.0	1,385	56.2	2,480
300	63.1	3,127	84.3	5,580
400	84.1	5,554	112.4	9,910
500	105.1	8,676	140.5	15,500
600	126.1	12,488	168.6	22,350
700	147.1	16,995	196.7	30,387
800	168.2	22,219	224.8	39,690
900	189.2	28,114	252.9	50,233
1,000	210.2	34,702	281.0	62,016

The rules about "overlapping" mentioned above may be broadened by stating that no one part of the surface illuminated should be made dependent on only one projector.

Since flood lighting projectors, especially when the rays are concentrated, produce a beam of high intensity, care should be taken to mount them in positions where their rays will not shine directly into one's eyes. This is particularly important when they are used in cities, as for instance, in flood lighting buildings facing directly on the street, for here the resulting glare might result in serious accident.

It is common practice, on account of the above, not to flood light city buildings located directly on the street below a point 10 or 15 feet above the street level.

Table B—Width, length, areas and beam dispersions.

		12° Dispersion			16° Dispersion		
		L	W	Area	L	W	Area
	θ	(Feet)	(Feet)	(Sq. Ft.)	(Feet)	(Feet)	(Sq. Ft.)
50 Feet	0°	10.5	10.5	86.6	14.1	14.1	155
	15°	11.3	10.9	96.7	15.1	14.6	173
	30°	14.1	12.2	135.1	18.9	16.3	241
	45°	21.2	15.1	251.4	28.7	20.1	452
	60°	43.5	21.4	731.1	59.7	29.0	1,358
	75°	185.4	51.1	7,440.8	289.4	64.7	14,700
100 Feet	0°	21.0	21.0	346	28.1	28.1	620
	15°	22.5	21.7	383	30.2	29.1	690
	30°	28.1	24.3	536	37.7	32.6	964
	45°	42.5	30.3	1,011	57.3	40.1	1,808
	60°	86.9	42.7	2,914	119.5	57.9	5,440
	75°	370.9	102.3	29,800	578.8	129.4	58,800
200 Feet	0°	42.0	42.0	1,385	56.2	56.2	2,480
	15°	45.1	43.5	1,541	60.3	58.3	2,760
	30°	56.3	48.7	2,153	75.5	65.1	3,860
	45°	85.0	60.6	4,046	114.7	80.2	7,230
	60°	173.9	85.5	11,678	239.0	115.8	21,750
	75°	741.7	204.6	119,186	1,157.7	258.8	235,400
300 Feet	0°	63.1	63.1	3,127	84.3	84.3	5,580
	15°	67.6	65.3	3,467	90.5	87.4	6,220
	30°	84.4	72.9	4,832	113.2	97.7	8,680
	45°	127.5	90.9	9,103	172.0	120.4	16,250
	60°	260.9	128.3	26,290	358.2	173.8	48,900
	75°	1,112.6	306.8	268,083	1,736.5	388.2	529,000
400 Feet	0°	84.1	84.1	5,554	112.4	112.4	9,910
	15°	90.2	87.1	6,170	120.7	116.6	11,050
	30°	112.5	97.2	8,588	150.9	130.2	15,430
	45°	170.0	121.2	16,182	229.4	160.5	28,900
	60°	347.9	171.0	46,724	478.1	231.7	87,000
	75°	1,483.4	409.1	476,627	2,315.4	517.6	942,000
500 Feet	0°	105.1	105.1	8,676	140.5	140.5	15,500
	15°	112.7	108.8	9,630	150.8	145.7	17,260
	30°	140.6	121.5	13,417	188.6	162.8	24,100
	45°	212.6	151.6	25,314	286.7	200.6	45,200
	60°	434.8	213.7	72,980	597.1	289.6	135,800
	75°	1,854.3	511.4	741,786	2,894.2	647.0	1,470,000

Don't Take Chances with Street Cars

The Ontario Safety League have been sending out, in the recent past, a quantity of literature drawing the attention of various classes of people to the necessity for watchfulness in their daily vocations that accidents may be avoided wherever possible. A typical bulletin is the most recent one, of which they have distributed some 10,000, and which has special reference to accidents between street cars and motorists. Added force is given to the warning by an illustration, as shown herewith. The number of chances of this kind that are taken daily by motorists make one wonder how it is possible that the accidents are not greater in number than the actual figures show. The following notice was sent out in post card form:

Taking a big chance.

COLLISIONS

TO MOTORISTS:

We need your assistance in preventing collisions between Automobiles, Street-Cars and Other Vehicles.

The following are a few suggestions:

1. Before you cross an Intersection look both ways and keep your car under perfect control.
2. When using the track allowance keep a sharp lookout for street cars following.
3. Use extra care when driving out of lanes or alleyways—the law places the limit at 4 miles per hour.
4. If forced to stop on the track behind a standing street car keep at least ten feet away—the trolley car may have to back.
5. Look out for the street car along side, which may turn to the right at an intersection.
6. Remember that an automobile can be stopped in much less distance than a street car, and bear in mind also that a street car cannot turn from its tracks to avoid a collision. Above all remember that a few seconds delay may avoid a serious accident.
7. Watch for pedestrians passing in front of a street car while you speed to pass, particularly at intersections.

Yours for greater safety,

ONTARIO SAFETY LEAGUE

Electric Cooking in Ontario Province

Tabulated Figures of the Actual Operating Costs in a Number of Cities and Towns—Individual Expense is Small

Of all the household electrical appliances that have gradually wormed their way into the good graces of the average home-keeper, none exerts so wide an influence probably, as the electric range. When all is said about the convenience and general utilitarianism of the other devices which may be used wherever there is a lamp socket, there is no getting away from the fact that the kitchen is the room where about 99 per cent. of the cooking in the regular home is done, and in the kitchen the all-important item is the range. It seems unnecessary to recapitulate the advantages of the electric kitchen—as a matter of fact no amount of reiteration is as good as a single glance into one of them. That glance reveals a state of absolute cleanliness and absence from poisonous odors which the user of coal or gas cannot appreciate without actually experiencing it. It reveals a room as cosy, neat and livable as any other room in the home.

It is strange how tenaciously our forefathers and mothers clung to the idea that the chief expense involved in the fitting up of a home lay in the direction of the "parlor," which was used on the average about one hour a week, while the kitchen, which was the home of the female portion of the family for some ten hours, and often more, every day, generally consisted of a "lean-to." It was an inexplicable attitude of mind, it is true, but nevertheless it has died hard. Even to-day many a householder will pay out, without question or murmur, money for articles which are used only at rare intervals, for his "best" room, while the kitchen equipment remains little better than a relic of the medieval ages. Why are we constituted thus? Can anyone say?

What we homekeepers in this twentieth century appear to be just realizing the rationalism of is, that our kitchens are the very "hearts" of our home business organizations. They occupy the same place relatively as the generating plant in a power system, and the way we have been comporting ourselves in the past with our modern parlors and our mediaeval kitchens is just the equivalent of painting the poles of our distribution lines when we ought to be repairing the broken insulators.

In a general way, of course, the salesman is up against these inexplicable hereditary anachronisms which makes it so much easier to sell a Victrola than an electric range. Improvement by evolution is a slow process, however, and the only rational method seems to be to institute a most vigorous campaign of education. The importance of the kitchen in the home must be pointed out and emphasized and reiterated again and again. It is an important factor in the "emancipation" of women and they, of course, should be the first to be convinced and enlisted as co-workers.

Little by little, evidence is accumulating of the satisfying results of electric cooking which will make it much easier as time goes on to educate and convince the general public. In actual fact, the results are better than any claims that were ever made for electric ranges. The equipment has not fallen down in any respect. Users are unanimously enthusiastic. Expenses are low, less than a few short years ago would have been thought possible. As evidence of this, we may refer to figures recently gathered by the Hydro-electric Power Commission of Ontario, from various municipalities, regarding average consumption per home, average per person, etc. The data received and published in the Hydro Bulletin covered some thirty municipalities, and the figures quoted below are interesting indeed. It will be remembered that the system of charging by these municipalities is uniform—a certain charge (3 cents) per 100 square feet of floor area, plus a primary meter rate for the first three kilowatt hours per month per 100 square feet of floor area, plus a secondary rate for all excess.

The most complete information was obtained from the city of London, where the rates mentioned above are three, two and one cents, with a 10 per cent. discount for prompt payment. The consumers are divided into groups, depending on the number of persons in the household. Of 49 families with only two persons in the family, the total monthly consumption, including range and all other electrical equipment, averaged 151 kw.h. The average of this same 49 before they installed the range was 32 kw.h. per month, leaving the average consumption of the range alone 119 kw.h. The average floor space occupied by these 49 families was 1,270. The average monthly bill, without the range, was 88 cents, and with the range, $2.03, so that the cost of cooking alone averaged $1.15 per month. The average range capacity was 5.13 kw. The average consumption of current per person thus works out at 60 kw., and the cost per person per month, at 58 cents.

Another group of 66 consumers in the city of London, having three persons in the family, had an average consumption of 171 kw.h. per month, where the consumption without the electric range had been 34 kw.h.; this left 137 kw.h. per month for the range alone, over an average of 66 families. The average floor area was 1,620 square feet, and the average monthly bill was $2.33, as compared with 99 cents before the installation of the range, leaving the average cost of the range per month $1.34. In this case the average capacity of the range was 5.35 kw. The average consumption per person works out at 46 kw.h. and the average cost per person at 45 cents.

An average of 53 families having four in the family gave a monthly consumption of 212 kw.h. with the range, as compared with 39 before the range was installed, leaving 173 kw.h. for the range alone. The average floor space was 1,770 ft. The monthly bill was $2.87 as compared with $1.15 without the range, leaving the cost of the range per month over an average of 53 families, $1.72. The average capacity of the range was 5.97 kw., the average consumption per month per person, 43 kw.h., and the average cost per month per person, 43 cents.

The number of families having five in a family, of which records had been taken in London, was 38. The monthly consumption in this case worked out at 205 kw.h. on the average, compared with 37 kw.h. before the range was installed, leaving 168 kw.h. for the range alone. The floor space averaged 1,780 square feet. The monthly bill averaged $2.82, as against $1.13 without the range, leaving $1.69 for the cost of operating the range alone. The average capacity of the ranges used was 5.5 kw., the average consumption per person per month was 34 kw.h., and the cost, 34 cents.

Twenty-two consumers, with six persons in the family, averaged a monthly consumption of 242 kw.h., as against 41 without the range, leaving 201 kw.h. per month per family for the range alone. The floor area averaged 1,830 square feet. The total cost averaged $3.16, as compared with $1.20 before the range was put in, leaving the range cost alone, $1.96. The average capacity of the range shows a slight increase to 6.15 kw. The consumption per person per month works out at 34 kw.h., the same as for the five-in a family group, and the cost per person, 33 cents.

Of families with seven in the family, eleven were reported, having an average consumption of 274 kw.h. per month, as against 68 previous to installing the range. This leaves 206 kw.h. for the range consumption alone. The average floor area is 2,050 square feet. The average cost per month is $3·58, of which $2.00 is the average for the range alone. In this case the monthly consumption per person works out at 29 kw.h., and the cost at 29 cents.

With eight persons in the family, six consumers were averaged, giving a total average consumption of 275 kw.h., of which 222 was for the range alone· The floor space was 2,050 again. The total monthly cost was $3.60, of which $2.14 was for range current. This gives the consumption per person per month as 28 kw.h., and the cost 27 cents.

Nine persons in the family, over an average of five, consumed 292 kw.h. each month, of which 256 was for the range· In this case the floor space was smaller, 1,480 square feet. The total cost of current was $3.74, of which $2.38 was for the range current alone. The average consumption per person was 28 kw.h., and the average cost 26 cents.

These figures, as well as those obtained from a number of other Ontario towns and cities, are tabulated below, and, in general, it will be seen that the cost is so low as to cause comment even among those who have had the greatest faith in the use of electricity for cooking purposes. It will also be seen that, in a general way, the figures indicate that as a family increases in size the cost per person is less· This is natural enough, as evidently a larger portion may frequently be prepared with practically the same heat consumption as the smaller portion, and particularly is this true where the range is not watched carefully and the energy conserved.

Hydro estimates have been forwarded the municipality of Glencoe, giving rates at which power can be supplied.

Tabulated results of consumption of energy by electric ranges, cost per month etc.

No. of families averaged	Size of family	Monthly consumption KW. hrs. without range	with range	of range	Floor area sq. ft.	Monthly bill without range	with range	for range	Range capacity KW.	Range KW. hrs. per month per person	Range cost per month per person
Brampton (rate 5c, 2c, 1c—10 per cent.)											
2	3	34	147	113	1850	$1.11	$2.32	$1·21	4.07	38	$0.40
3	4	54	200	146	2567	1.66	3·18	1.52	4.55	37	.38
2	5	44	248	204	2500	1.47	3.58	2.11	5.12	41	.42
Average of all		43	233	190	1625	1·49	3.51	3.02	5.65	..	....
Galt (rate 3c, 2c, 1c—10 per cent.)											
Average of all		30	229	199	1880	1.04	3.04	2.00	....	..	....
Goderich (rate 3c, 4.5c, 2.25c—10 per cent.)											
4	3	52	228	176	1500	.99	5.25	4.26	5.44	59	1.42
2	4	100	249	149	2000	3.41	6·79	3.38	5.89	37	.85
Guelph (rate 3c, 2c, 1c—10 per cent.)											
2	5	49	450	401	2800	1.55	6.57	4.02	6.25	80	.80
2	6	47	308	261	2900	1.62	4.34	2.72	6.55	44	.45
Hamilton (rate 3c, 2c, 1c—10 per cent.)											
6	3	29	141	74	....	....	....	....	4.83	25	....
4	4	27	188	91	....	....	....	....	5.45	23	....
5	5	24	172	98	....	....	....	....	5.76	20	....
Average of all		33	159	113	....	....	....	....	4.9	..	....
Kitchener (rate 3c, 2c, 1c—10 per cent.)											
2	3	33	255	222	....	.94	3.04	2.10	3.8	74	.77
4	4	29	209	180	....	.87	2.76	1.89	3.14	45	.47
London (rate 3c, 2c, 1c—10 per cent.)											
49	2	32	151	119	1270	.88	2.03	1.15	5.13	60	.58
66	3	34	171	137	1620	.99	2.33	1.34	5.35	46	.45
53	4	39	212	173	1770	1.15	2.87	1.72	5.97	43	.43
38	5	37	205	168	1780	1.13	2.82	1.69	5.5	34	.34
22	6	41	242	201	1830	1.20	3·16	1.96	6.15	34	.33
11	7	68	274	206	2050	1.58	3.58	2.00	5	29	.29
6	8	53	275	222	2050	1.46	3.60	2.14	5.05	28	.27
5	9	36	292	256	1480	1.09	3.47	2.38	6.5	28	.26
2	10	144	536	392	2650	2.72	6·26	3.54	6.5	39	.35
Average of all		39	200	161	1613	1.09	2.67	1.58	5.35	..	....
St. Thomas (rate 3c, 2c, 1c—10 per cent.)											
2	2	16	102	129	1500	.59	1.73	1.31	6.4	..	....
9	3	38	183	122	1856	1.21	2.65	1.21	6.3	41	.40
7	4	48	200	147	1657	1·34	2.69	1.38	6.2	37	.34
5	5	43	246	232	1540	1.15	2.99	2.16	5.96	46	.43
2	6	36	253	217	1300	.93	2.98	2.05	6.4	36	.34
Average of all		44	207	172	1680	1.24	2.78	1.63	6.19	..	...
Windsor (rate 3c, 4c, 2c.—10 per cent.)											
9	2	29	136	114	1539	1.41	3·55	2.03	5.82	57	1.02
14	3	27	157	145	1247	1.32	3.90	2.83	5.92	48	.94
12	4	29	180	149	1133	1.35	4.09	2.85	5.7	37	.71
8	5	41	158	139	1341	1.73	3.93	2.60	5.93	28	.52
5	6	50	164	103	1307	2·20	3.90	1.87	5.43	17	.31
2	7	..	235	...	1650	....	5.57	....	5.5	..	...
Average of all		32	163	136	1306	1.49	3.92	2.57	5.76		.

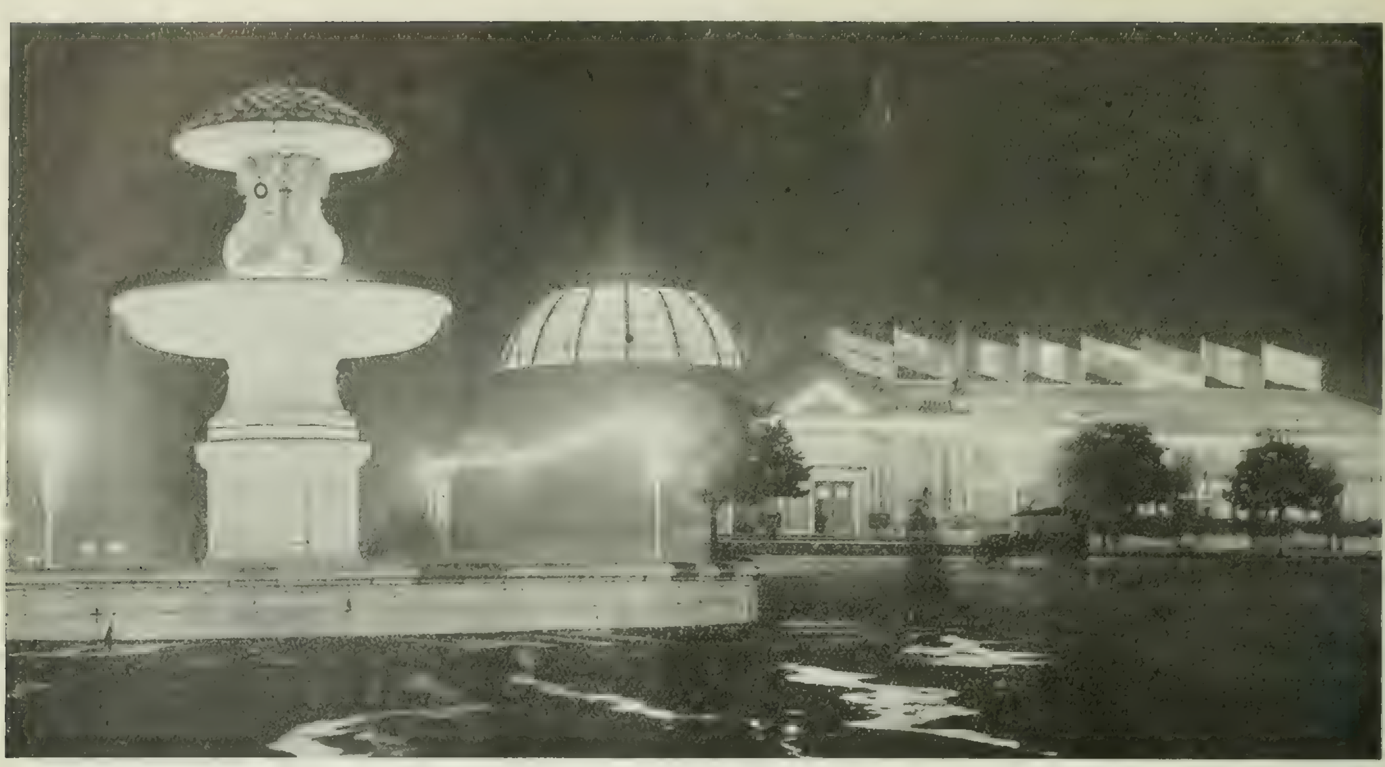


Fig. 1.—General view of section of grounds at night—Fountain and Horticultural Building.

Display Lighting at the Canadian National

Now One of the Big Features of the Fair—Grand Stand Color Work Highly Commended by Visitors

At no other place in Canada, probably, has there been so much brilliant and spectacular illumination concentrated in the same area as was shown this year at the Canadian National Exhibition, Toronto. Each year electricity, in one form or another, has been a prominent feature of the show, but the recent developments in lamps and reflectors has made it possible to concentrate on the lighting features with astonishing effect. It is exceedingly doubtful if anything more beautiful or wonderful than the flood light effects shown during the evening grand stand performances has been worked out anywhere on the continent.

Some of the main features in both general illumination and flood lighting are illustrated. Next to the grand stand displays probably the most remarkable bit of illumination is shown in Fig. 1. In this picture is shown, in the foreground, the fountain lit up by flood lights arranged around the outer rim of the large catch basin and just below the surface of the water. The lamps were installed in groups of nine 200-watt tungstens set in cast iron reflectors rendered water-tight by plate glass covers. The number of such groups was 16. Sets of white, green and blue lamps were used alternately, one color in each reflector. The dome in the centre of the picture is that on the horticultural building, and is lit up by means of 16 rows of lamps—212 in all. These are arranged in alternate rows of red, white and blue. The blue and white lamps were 40-watt, but it was found necessary to use 100-watt red lamps to get the correct effect. The "flags of all nations," also on the horticultural buildings, are flooded with light by large 24-inch reflectors similar to those used on the grand stand, described later.

Fig. 2 is a good example of the general outline effects featured practically all over the grounds. This particular section, following the double line of light in the left half of the picture and turning at right angles to the right along the whole background, is the "midway." There are some 2½ miles of this wiring, carrying P. & S. sockets, which is stored away from year to year ready wired and added to as required, and which is used exclusively for "outline" effects.

Fig. 3 shows the main Dufferin Street entrance to the exhibition—quite an impressive introduction to the Fair and

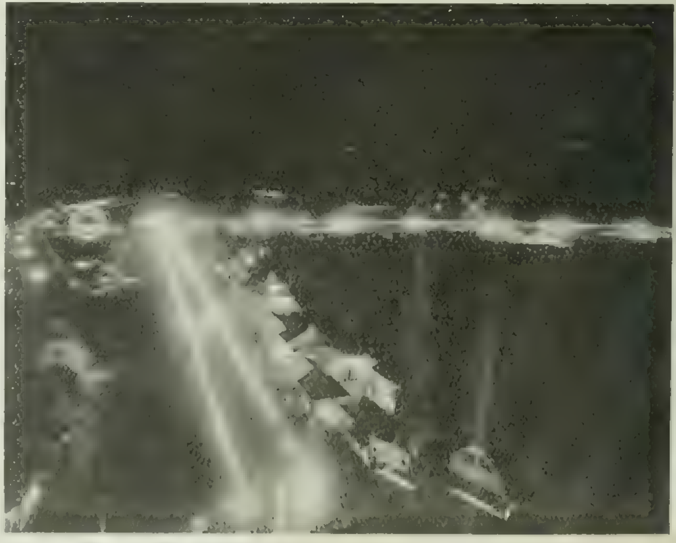


Fig. 2.—Outline lighting along the midway.

calculated to give the visitor a favorable impression of the wonders that lie beyond.

From a strictly spectacular point of view the grand-stand color work was equal to the best that Canadians have yet had an opportunity of enjoying, and was most favorably commented upon by visitors from all parts of the continent. The source of light is some forty odd flood reflectors installed on the roof of the grand stand. Of this number, twenty-four (twelve on each wing of the roof) are stationary and as such are used for fixed general lighting. The remainder occupy the centre of the stage and are movable, the movement being manually operated. These forty reflectors are each 28 inches in diameter and were manufactured on the grounds by the exhibition organization. The inner reflecting surfaces are copper-nickel plated. Each reflector carries a 1,500 c.p. nitrogen lamp with special concentrated filament manufactured expressly for the purpose.

The beautiful color effects which caused so much comment, are obtained by placing glass screens of various colors in front of the flood lights. All the movable reflectors are provided with racks into which the glass frame slips like a lantern slide. The constant changing in color effects, which required both a manipulation of the reflectors and frequent changes in the screens, was accomplished by a "battery" of manual operators—one man, in general, to three reflectors—with a number of attendants. Varying degrees of light were accomplished by means of a dimmer resistance consisting merely of two barrels, in multiple, of weak electrolyte in which the two terminals are immersed and so controlled that they may be adjusted readily to varying distances apart.

Summed up, the electrical features of the Canadian National represent a demand equal to a city of very considerable dimensions. In all, about 2,000 h.p. is required. The load consists of a variety of motors in addition to about 60,000 lamps of sizes from 2 c.p. to 1,500 c.p. Briefly and roughly, the lamp load is as follows:—monogram sign, 1,800—15-watt tungstens; building lighting, 2,400—200-watt nitrogens; street lighting, 500—100-watt nitrogens; outline signs, 20,000—15-watt tungstens; general use, some 30,000 odd. The luminous ball on the 80-foot tower uses 1,450—15-watt units.

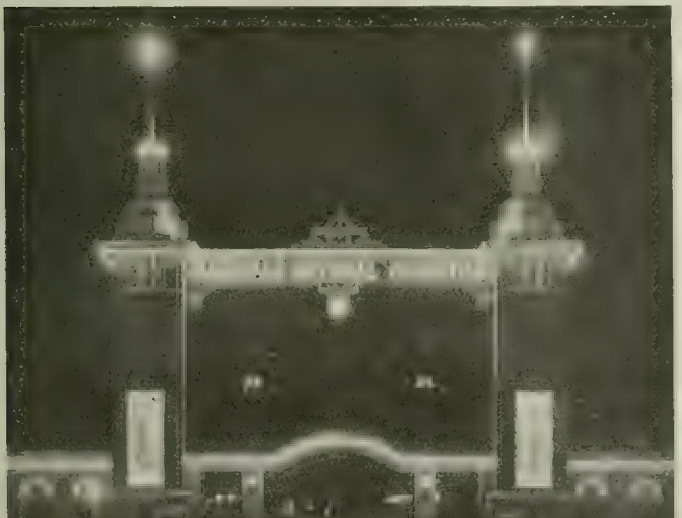


Fig. 3.—Entrance to Exhibition grounds.

Another very prominent feature of the exhibition electrical display was the monogram talking sign installed on the manufacturers' building. One view of this sign is shown in Fig. 4. Its over-all dimensions are 35 ft. high by 45 ft. wide. On one side there is shown the United States flag and on the other side the flag of the British Empire. This equipment consists of 36 monogram boxes, each box capable of flashing any letter or numeral as well as several other characters. It will be seen that these monograms are placed in three horizontal rows, twelve in a row. In each monogram there are 21 sockets arranged as three horizontal, three vertical, and two diagonal rows—765 in the 36 monograms. In the whole feature there are 1,900 15-watt tungstens.

The sockets in each monogram box are connected in groups (each of which form one letter or group) to the various sections of a commutator so that there are in all 36 commutators each with 40 sections, that is, each commutator is capable of showing 40 letters. Thus the machine fully equipped and including blank spaces would contain nearly 1,500 leters. The sentences are set up in order and the machine reproduces them in sequence automatically, requiring practically no attention except occasional inspection when the machinery has once been set going.

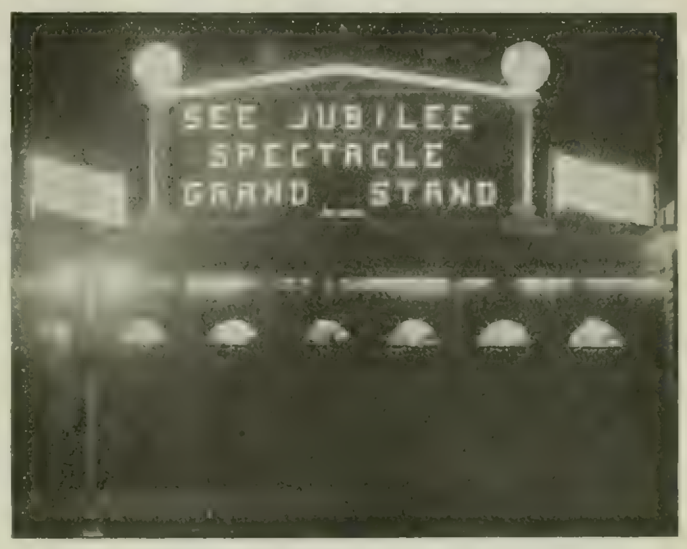


Fig. 4.—The monogram or 'talking' sign.

The flags at each side of the talking sign were operated from a flasher which gave them a very natural waving effect. This flasher was operated by a 1/20 h.p. motor. The talking sign was run by a ¼ h.p. motor. As indicating the very wide possibilities of a sign of this nature, it may be interesting to quote the various messages which were flashed out to the visiting throngs during the evenings of the two weeks of the exhibition. These were run in some such sequence as given below, and when the whole series had been flashed, from 1 to 22, they automatically started over again. Below are the messages:

The Messages

1. Toronto Heartily Welcomes Exhibition Visitors.
The Mayor.
2. Grand Stand Performance with Artillery Drive each afternoon.
3. It is to secure the Sacred Principles of Justice, Freedom and Humanity that we fight, and by God's Help we mean to triumph. The King.
4. Waste Means Defeat. Help the Fighters to Win.
Hanna.
5. See the Jubilee Spectacle. Grand Stand each evening. Twelve Hundred Performers.
6. Our Responsibility and Duty cannot be evaded. Victory is the Supreme Concern of the Canadian Nation.
Borden.
7. Fine Art Gallery is open Daily. Wonderful collection of French, Italian and Canadian Pictures.
8. Midway Just East of the Grand Stand.

9. American Day is Tuesday of the Second Week. Write your U. S. Friends. No Passports required to enter Canada.
10. Help Win the War. Practice Thrift and Buy War Certificates R. B. Bennett.
11. Production, Conservation and Fish Exhibits in Government Building.
12. Buy an Official Exhibition Catalogue—10c.
13. Come Again and Beat the Million Year Record.
14. Dog Show Tuesday and Thursday of Second Week.
15. We Shall Never Sheathe the Sword until the Military Domination of Prussia is Destroyed. Asquith.
16. Athletic and Military Sports on Final Saturday of Exhibition.
17. The Urgent Call for Reinforcements Must Be Answered by the People of Canada. J. S. Hendrie.
18. One Million Dollar Display Persian Art Treasures, Applied Art Building.
19. Official Canadian War Pictures, Army & Navy Equipment Building.
20. Let Us Set for Ourselves a Standard so High that It Will be a Glory to Live Up to It. President Wilson.
21. Motor Boat Races Monday, 5.30 to 6.30.
22. Next Year Greater Than Ever.

The exhibition management is to be congratulated on the very considerable success that has attended their efforts to demonstrate to visitors the great possibilities underlying the generous and proper application of electric light. As an advertising feature, too, there is probably no single item that gives so much value for so small expenditure. It is to be hoped that Mr. Andison, the electrical superintendent, who had complete charge of all the electrical features this year and is, in great measure, responsible for their success, will be given the necessary support to continue his improvements so that the Canadian National may come to be looked upon, from the viewpoint of electrical displays, as a continental standard.

Accurate Substitute for Daylight

With each increase in the efficiency of light production by means of incandescent filaments, comes a broader opening to new fields of usefulness for the incandescent lamp. Step by step the color quality of artificial illumination has improved from that offered by the carbon lamp to that which is obtainable from the present gas-filled lamp. The higher filament temperature and the resulting whiter light produced at a much higher efficiency has made it possible, from the practical standpoint, to go a step farther to produce artificial illumination of daylight color quality. As a result of this, commercial units designed to supply a substitute for several gradations of daylight have been developed. Among these is the "Trutint" unit for accurate color matching. This unit utilizes a glass color screen plate which absorbs excess green, orange, red, and yellow light rays from the filament of the lamp, permitting the transmission of an accurate north sky light. The unit has withstood such severe tests as found in grading cotton, mixing dyes, etc., but as its efficiency is not high enough to permit its use for general illumination, its field is limited to the lighting of small areas.

The Latest Daylight Lamp

To meet the demand for an economical artificial illuminant of approximate daylight color quality for general illumination, the Mazda C-2 lamp has more recently been developed. The advantages of this development over previous [illegible] the same purpose are that this lamp can be used with any type of reflector equipment, and it requires [illegible] color screen. The Mazda C-2 lamp is identical in construction with the Mazda C lamp with the exception that the glass bulb is of a blue-green color. The filament, operating in an atmosphere of inert gas, is helically coiled and concentrated in the centre of the bulb. The colored bulb serves as an absorber of some of the green, red, yellow, and orange rays from the initial light, with the result that the filtered light has a color quality of afternoon sunlight. As a certain amount of light is absorbed by the colored bulb, the efficiency is decreased from that of the Mazda C lamp to approximately that of the Mazda B or vacuum lamp.

The Mazda C-2 lamp should not be confused with the Mazda C-3 lamp which has been designed for photographic purposes. Both have so-called blue bulbs but even casual observation reveals a great difference in density and in color. The bulb of the Mazda C-3 is very dense, transmitting only about 35 per cent. of the light, and is of a deep voilet color. It transmits the ultra-violet rays which are useful in ordinary photography. The "daylight" bulb of the Mazda C-2 lamp is made of a different glass, and transmits about 65 per cent. of the total light, but containing elements which do not transmit ultra-violet light very readily. It appears more greenish in color than the Mazda C-3 lamp.

Some of the leading fields for the Mazda C-2 lamps are art galleries, department stores, haberdasheries, cigar stores, clothing stores, millinery shops, tailoring shops, shoe stores, jewelry shops, paint and wall paper stores, furniture stores, undertaking establishments, laundries, dry cleaning, medicine and surgery, hospitals, color-printing, hardware stores, libraries, grist mills, florist shops, automobile display rooms, textile plants, photographic studios, offices, drug stores, barber shops, laboratories, microscopy, grocery stores, confectionery stores, hair-dressing, show-windows, fur stores, breweries, dentistry, and in many other stores and in isolated cases. In office lighting, annoying conditions, due to the difference in the colors of daylight and ordinary artificial light, have been eliminated in a number of cases.

Two suggestions may be of value to those installing Mazda C-2 lamps:

1.—Use 50 per cent. greater wattage than in Mazda C lighting.

2.—Use same wattage as in Mazda B lighting.

Technical data on Mazda C-2 lamps are given in Table 1 herewith:

Table No. 1

Technical Data on Mazda C-2 Lamps

Watts	Watts per spherical candle-power	Lumens per watt	Total lumens	— Bulb — Type	Diam. in inches	Base	Position of burning	Rated average life, hours
75	1.58	8.0	600	PS-22	2¾	6⅛	Med. Screw	700
100	1.44	8.7	870	PS 25	3⅛	7⅛	Med. Screw	700
150	1.34	9.4	1400	PS-25	3⅛	7⅛	Med. Screw	700
200	1.25	10.1	2000	PS-30	3¾	8⅜	Med. Screw	700
300	1.12	11.2	3350	PS 35	4⅜	9¾	Mog. Screw	700
500	1.12	11.2	5600	PS-40	5	10	Mog. Screw	700

The Minnedosa Power Company have been experiencing trouble on account of lack of water supply at their plant on the Little Saskatchewan River, just north of the town. The Little Saskatchewan is fed by tributary streams which drain lakes in the Riding Mountains and until lately the flow has always been adequate. The trouble has developed due to the activities of beavers which have been building dams across the tributary rivers in great numbers. The result is that the Little Saskatchewan is likely to become almost dry this winter unless these animals are moved on to other streams. Mr. Geo. A. Grierson, member of the legislature for Minnedosa, has asked that the chief game warden be instructed to take the necessary action to rid the town of this menace. He thinks that if this is done without delay the beavers will have ample time to establish themselves in new quarters before winter.

Lighting of An Underground Passage

New Lamps Utilized to Produce a Daylight Effect—Automatic Control of Switches—Storage Battery for Emergency

An unusual underground passageway constructed through a hill on which the laboratory and office buildings of the National Lamp Works are situated at Cleveland is described in the Electrical World. The purpose of the passage is to provide a comfortable approach to the top of the hill in addition to an outdoor stairs. Two desirable characteristics were that the pasageway be dry and well lighted. The subway, as it is called, is 312.92 ft. long, and rises 34.22 ft. in that distance. Keeping the walls free from condensate so that the subway would always be dry proved comparatively simple; but not so the lighting. The primary object to be attained by the lighting was twofold. It should remove that dingy atmosphere which is present in almost all underground passages, and it should enhance the appearance of the interior.

As the first step in determining what sort of lighting would best accomplish these effects, a quarter-scale cardboard model was built and several schemes of lighting it were tried. It was decided as the result of this rough investigation that lighting which would simulate daylight in color and distribution would be the most desirable. Such a lighting scheme, it was believed, would lessen the sense of being underground. While it was not the intention to convey the impression of an up-ground passageway, the simulation of daylight is so complete that many visitors are deceived.

All of the lighting-circuit leads are run in conduit laid in the air ducts between the walls. At each of the thirty-two windows a branch is taken off one of the three-wire No. 8 lines to serve a 100-watt, 110-volt blue-glass daylight lamp installed in a show-window lighting reflector. The type of three-wire circuit which is used was selected so that the line drop could be taken care of by installing lower-voltage lamps of a single rating for the entire length. The glass used in the window panes is a translucent glass known as "cynite," that is high in transmission efficiency but is sufficiently scattering in its refraction not to reveal any of the details of the wall behind it.

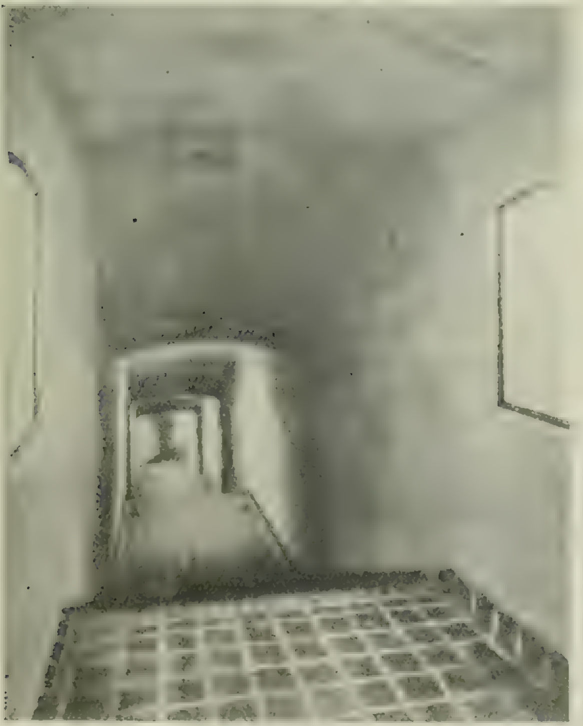


Fig. 1—Underground passageway that is apparently illuminated by sunlight.

Uniform Illumination Avoided

Uniform illumination is not provided. This was in order that the alternating lights and shadows might break up the long passageway and make it seem shorter. In placing the windows locations were selected which would allow adequate lighting of the 4 per cent. ramps and five runs of stairs, which are laid out with eight steps to the run. The plan of placing the windows opposite one another was considered better than staggering them, since the latter arrangement would have given the subway a zigzag effect.

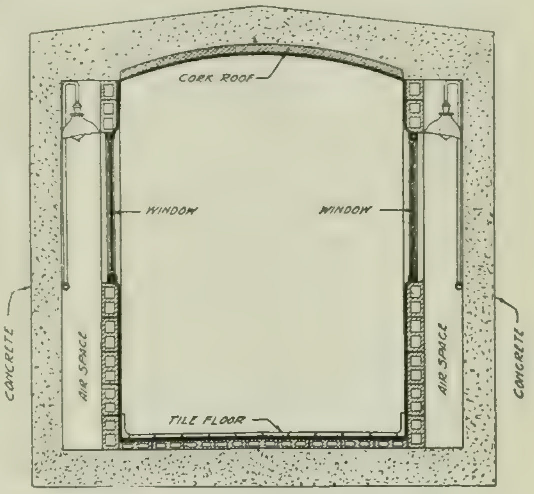


Fig. 2—Shows wiring plan for lighting passageway.

Of equal importance with the consideration of effect of the lighting came that of its reliability, for darkness in such a long, narrow passage at rush hours would create an extremely dangerous condition. Solution of the reliability problem was reached by installing an emergency lighting circuit carrying six 15-watt tungsten lamps, which operate continuously on the central station lighting circuit as long as energy remains on the lines. Should this power source fail, a relay which is retained in position only by the central station energy would, actuated by gravity, fall and connect the emergency circuit to a storage battery ordinarily used in the laboratory for testing work.

Control Either Manual or Automatic

The main lighting circuits are arranged for either manual or automatic control as desired. There are door switches at both entrances to the subway arranged so that opening the door turns on the thirty-two daylight lamps whenever the control mechanism is set for automatic operation. The same action sets a time switch in action so that it will turn the lights out in four minutes. A person can walk through the subway in from one and one-half to two minutes. Should another person enter the passage before the end of any four-minute period for which the lamps are lighted the time switch would be automatically set back to its starting point, and the lamps would operate another full four minutes.

These automatic operations are all performed on a panelboard, the essential elements of which are a standard remote-control switch, a clock mechanism connected to the subway door switches, a relay for the emergency lighting, a small three-pole knife switch for cutting out automatic operation and substituting manual control, a pilot lamp in the emergency circuit, and a push-button in the door circuit which can be used in testing at the board.

The automatic system will properly take care of the lighting for all ordinary traffic in the subway. It has been found, however, that, at least during the winter months, the automatic system keeps the lights on continuously through the greater part of the day on account of the frequency with which the subway is used. Therefore it has been considered advisable to disconnect the automatic mechanism during the busy hours of the day. This can be done by a watchman on his regular rounds and it saves the wear on the mechanism. The automatic system is most useful in taking care of the lighting after the busy hours are over and during the hours and days of infrequent traffic.

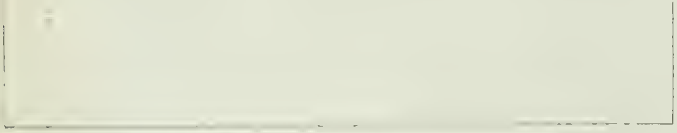
The entire work of the design was done by Evan J. Edwards of the laboratory's engineering staff. His original solution of the engineering problems recounted here is of special interest because so far as it is known the problems are entirely without precedent.

Electric Appliance Business in Edmonton

By A. W. Ormsby*

Previous to the summer of 1916 the electric appliance business in Edmonton was handled by the local dealers, and with a fair amount of success. It was felt, however, that considering there is no gas competition in this city and about ninety-five per cent. of available houses are connected, the sales could be considerably increased. The City Electric Light Department created a commercial section with this object in view and the results have more than justified the expectations and warranted the comparatively small expenditure necessary.

A fully equipped showroom was installed in the office where customers pay their electric light bills. The demonstrating and sales are handled by a capable young lady member of the office staff, who also attends to other electrical work. A man with technical training is available in the office when necessary, and is in charge of this commercial section. These features were advertised extensively in the local newspapers, the keynote of all the earlier advertising copy being "a desire to give reliable information and advice about anything electrical," i.e., "Service." We have been very successful in this respect and have apparently been able to inspire confidence. Many people take the opportunity to discuss their electrical problems, which has almost invariably resulted in sales being made. The fact that we are a municipal department has also possibly helped in this matter of gaining the confidence of the citizens. People calling at the office to pay their electric light bills have been interested in the display and sales were made in many cases where prospects would probably have not bothered to enter an electrical store.



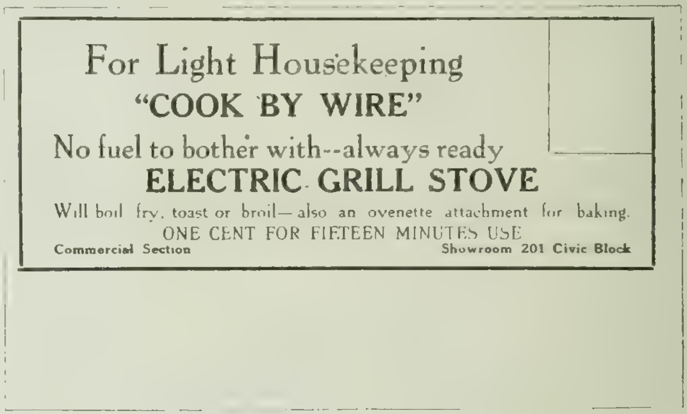
MAKE
THE
ELECTRIC
LIGHT
SOCKET
YOUR
SERVANT

ELECTRIC

IRONS
TOASTERS
GRILL STOVES
At our own Showrooms
201 CIVIC BLOCK

Typical postal card on which accounts are sent.

Electric light accounts are delivered in the form of postal cards, and about two-thirds of the address side is used for advertising copy, which is changed monthly. This has proved to be very effective advertising and at a nominal cost. Advertising matter for special features and manufacturers' envelope enclosures were also delivered by the meter readers on their monthly visits. Local newspaper advertising is carried out at a minimum of once a week.

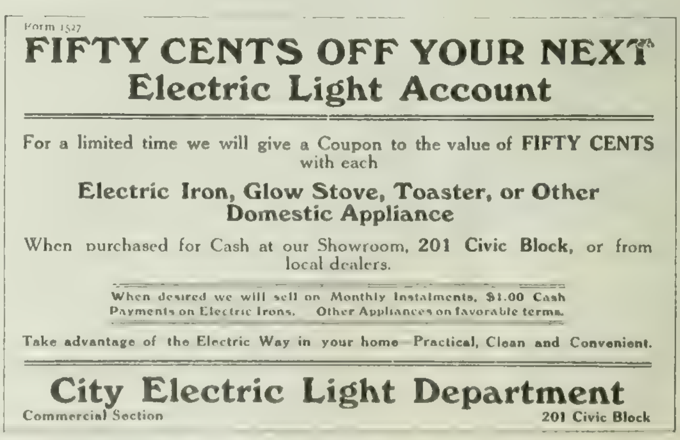


For Light Housekeeping
"COOK BY WIRE"
No fuel to bother with--always ready
ELECTRIC GRILL STOVE
Will boil fry, toast or broil—also an ovenette attachment for baking.
ONE CENT FOR FIFTEEN MINUTES USE
Commercial Section Showroom 201 Civic Block

Typical postal—Advertisements are changed monthly.

Meter readers are given a commission on all sales where they actually collect the money. Some of them have proved to be very good salesmen and continue to add an appreciable amount to their monthly salaries by commissions on these sales. The housewife is often interested to enquire about the meter reading and the meter reader has an excellent opportunity to guide the conversation to the subject of electric domestic appliances. Sales are thus made quite frequently and to the mutual advantage of all concerned.

Several special features have also been introduced to



Form 1527

FIFTY CENTS OFF YOUR NEXT
Electric Light Account

For a limited time we will give a Coupon to the value of FIFTY CENTS with each

Electric Iron, Glow Stove, Toaster, or Other Domestic Appliance

When purchased for Cash at our Showroom, 201 Civic Block, or from local dealers.

When desired we will sell on Monthly Instalments, $1.00 Cash Payments on Electric Irons. Other Appliances on favorable terms.

Take advantage of the Electric Way in your home—Practical, Clean and Convenient.

City Electric Light Department
Commercial Section 201 Civic Block

Fifty cent coupon to boost appliance sales.

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*Superintendent Light and Power.

boost sales, one in particular proving very successful. This was a coupon worth fifty cents off the next electric light bill. These coupons were issued for a limited period with each cash purchase of an electric iron or toaster. Arrangements were made with practically all local dealers to also issue these coupons, in which case the Electric Light Dept. charged 25c back to the dealer for each coupon cashed in. This coupon was the only equivalent to price cutting which was introduced, all appliances being maintained at the regular resale price.

Use Monthly Payment Plan

The monthly payment plan was introduced after a considerable amount of cash business had been done, and this again helped to boost sales and continues at the present time to be a very popular feature. As all purchasers on this plan must be already on the books as electric light customers it is a very simple matter to eliminate the few undesirable accounts. The payments are added to the monthly electric light bill, and as each light account is covered by a guarantee deposit the sale is almost as safe as a cash one. Our bad debts from this source have been practically nil. The contract form which is signed specifies that such payments are not refundable, also the total becomes due immediately the lighting account is closed.

Ten per cent. is added to the cash price for monthly payment sales. Irons and toasters are sold for one dollar cash and the balance at one dollar a month. All other appliances are sold on the basis of one quarter cash and the balance in six equal monthly payments. This monthly payment plan appeals to many people, and since it was introduced we have succeeded in putting quite a considerable additional appliance load on our lines.

The lighting rate is seven cents per kw.h., and cooking rate, when registered on a separate meter, three cents per kw.h. Both rates are subject to 10 per cent. discount for prompt payment.

Co-operation With Local Dealers

Appliance stock is bought from the local dealers at a slightly less discount than they obtained from the wholesale jobbers. This plan was adopted in order to secure the co-operation and keep the goodwill of the local electrical men, and has proved quite satisfactory. They are not in a position to deal with the monthly payment sales, but still secure the benefit of the increased business which could not be reached on a cash sale basis. It might be mentioned that all repair work on cords, etc., is left in the hands of the local dealers.

The foregoing is just a brief outline of some of the methods that have proved successful in increasing the appliance sales in this city. We confidently expect that by continuing such methods and co-operating with the local electrical men we shall eventually reach the desirable condition when every home will have its equipment of electrical domestic appliances.

Domestic Appliances in Regina

By E. W. Bull*

The use of electric domestic appliances, especially ranges and water heaters, is of considerable importance to central stations to assist in filling the valley of the load curve, and should be encouraged by fixing a reasonable rate and by advertising and demonstrations showing the advantage and convenience of electrical appliances.

In Regina we have adopted a combined rate for domestic light, heating and power, as follows: The first fifty kilowatt hours per month being charged at lighting rates, the balance of consumption being charged at 1¼ cents per kilowatt hour, with a service charge of fifty cents per kilowatt of demand on all of lighting service, and on sixty per cent. of heating appliance demand.

We are also handling electric ranges and water heaters at cost, and allow time payments for these appliances, and also rent ranges for a limited time to customers who are doubtful of the advantages of electric cooking.

A rather healthy movement has started toward the use of electric heating devices and many consumers are taking advantage of our reasonable rates and sales department for ranges and water heaters. I attach herewith a circular letter which explains our rate for this kind of service:

Typical Circular Letter

Regina, Sask., August 30th, 1917.

Dear Sir:—

In case you are interested in the operation of an electric range we would say that both range and light supply go through one meter and one bill would supply to both the range and lighting service. The rate being, that the first 50 kw. hours will be charged at lighting rates, all over this consumption being charged at 1½c. per kw. hour. The service charge will apply to your lights as at present and to 60 per cent. of the range capacity. A representative bill for a consumer using a 5 kw. stove using 190 kw. hours for both stove and lights would be as follows:

Light service charge	.50
Range service charge	1.50
20 kw. at 7c.	1.40
30 kw. at 6c.	1.80
140 kw. at 1¼c.	1.75
Total bill	$6.95

Subject to a discount of 10 per cent.

In case a large family making further use of this range adds 50 per cent. to the range consumption, the bill would then be increased by only $1.05, also subject to a discount of 10 per cent.

You will see that although you cannot hope to get a bill for less than $6 or $7, considerable use can be made of the range without adding greatly to this amount.

This feature may be taken advantage of by using a water heater for hot water service in your home. As a sample of what bill may be expected from this combination service I have examined the account of an installation consisting of lights, ranges and water heater, and where the occupants consist of two families and a servant, and find that the total consumption for one month was 400 kw. hours, and on this basis of new rates the monthly bill was $8.62, after taking advantage of the discount.

Trusting this information will be of service to you, and that you will decide to install this service, I am,

Yours very truly,
E. W. Bull.
Supt. Light & Power Department.

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*Supt. Light and Power Dept.

Modern Ideals of Factory Lighting—I.

By C. E. Clewell*

The many advantages and the fundamental importance of adequate lighting in the industries are now beginning to be appreciated by those who are responsible for this phase of the factory equipment. The remarkable changes which have been made in the design and installation of the lighting system have not, however, reached a point where they may be said to be fully standardized for given processes of manufacture, and there are many cases still to be found where, either through neglect or through ignorance of the ways and means for accomplishing the best results at the least expense, the new ideas concerning the illumination for factory interiors are not understood. It is the purpose of this article, therefore, to call attention to some of the more important aspects of the problem, and to suggest some of the details whereby the average factory manager may secure for his plant a system of lighting which will be in keeping with the possibilities which are now available.

The increasing attention which has been given to the lighting question is due partly to a realization of the important effect which can be produced on manufacturing methods by an effective lighting system, and also to the fact that the development of modern lamps within the past few years has made it possible to obtain illumination results with the newer equipment which could not be realized in former years with the less efficient lamps and the smaller number of types and sizes of illuminants then available. Factory lighting as it is understood to-day is therefore a development both in the physical equipment on the market as well as in the attitude which has been taken towards the working conditions which surround employees in their every-day work.

Natural Light in Its Relation to Artificial Lighting

The relations of natural light to the problem of artificial lighting requirements are so vital to the subject that it is important in a discussion of this kind to emphasize at the outset that a poorly designed factory with inadequate window areas must depend on artificial light during a greater portion of the day than those structures which have been planned with due regard to the supply of sufficient quantities of daylight throughout the entire interior of the building. While many improvements have been made in the planning of artificial lighting, it is to be noted that corresponding developments have been made in the sizes and arrangements of window openings, this feature in the construction of industrial plants having gone far to the solution of the lighting problem during normal daylight hours. Figs. 1 and 2 are included at this point merely to give a general idea of the window plans in a modern plant, and these views indicate clearly that the older factory structures, which are so familiar on every hand, are fundamentally different in shape and in wall construction from these more modern types, where increasing emphasis has been placed on adequate window spaces.

In Fig. 1 the main point to note is that the entire floor area is flooded with a generous supply of natural light by side windows, as well as by windows located in the roof, and in Fig. 2 the exterior window arrangements are clearly shown. Note in this view that the ordinary plan of rectangular windows in the side walls are beginning to give way to steel window sash in a variety of shapes, the one in this instance being in the form of continuous sash which is con- [illegible] plan as shown in this view it is possible to regulate both the lighting and the ventilation for the interior spaces, these two items being naturally closely related to each other in the plans of any factory.

Even in well designed buildings, however, and more particularly so in older structures, there are likely to be many times during various days throughout the year when the condition of the weather is such as to render the natural lighting very inadequate in certain parts of the plant, and aside from any requirements for artificial light at night, it is absolutely essential that every factory be provided with an artificial lighting system for the purpose of tiding over these dark periods. Furthermore, in the winter months there are often periods in the early morning and in the late afternoon when the intensities of natural light fall below the minimum values for good workmanship, and here again it is most important that artificial light can be used to supplement the inadequate day-light. As a starting point it should be noted, therefore, that the problem of artificial lighting is not confined solely to those factories where night work is conducted, but that very few factories are to be found where it is not an almost equally important feature in the day work.

Increased Value of Floor Space

From what has just been stated it follows that a factory which has not seen fit to install a system of electric lamps as part of its equipment, is likely to find itself in a position on dark days and in the early morning and late afternoon periods of winter months whereby workmanship is greatly retarded by the lack of sufficient day-light. It is readily perceived, therefore, that if the net production which can be realized per day throughout the year is reduced by a given percentage through the absence of suitable light, that the factory floor space is not being utilized to its highest value, and that it is therefore less effective than a corresponding floor area where adequate light throughout the entire day makes it possible to maintain production at its normal rate at all times.

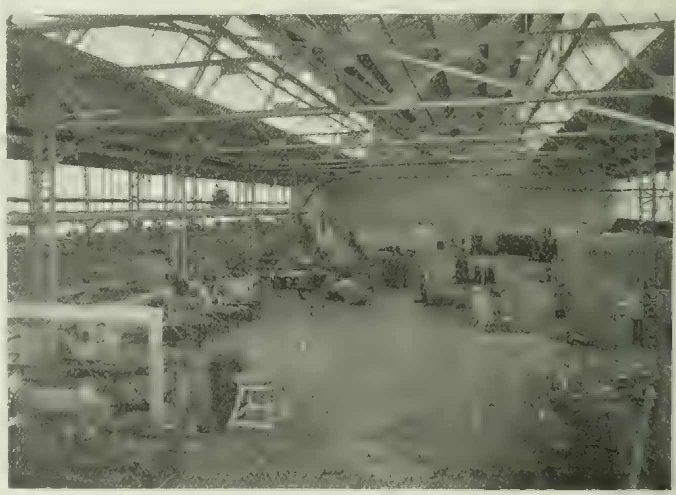

Fig. 1 -Interior day view of building of iron company—Excellent uniform natural illumination by proper window construction.

Another most interesting phase of this same question is that of certain factory sections which are so far removed from windows that they are dark at all times throughout the day. In such cases the natural tendency is to locate the work near windows and to use these dark spaces for storage or possibly even to leave it entirely idle. As the work becomes congested in the plant it may become necessary to utilize these dark spaces, and unless they are supplied with plenty of artificial light, they will be found to be unpopular with the employees because of the marked contrast with the brighter sections, and moreover, it will be impossible to perform as accurate, and as much work in the dark section as in the brighter areas. The poorly lighted areas may thus be looked upon as of less value per square foot than the brighter spaces, and it follows logically that the installation of a modern lighting system has the effect of enhancing the value of these dark areas.

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*[illegible] Professor of Electrical Engineering, University of Pennsylvania

Fig. 2—Exterior view of modern factory, designed to give effective natural lighting results.

Reduction of Accidents

One of the outstanding factors in favor of good lighting is that of its relation to the accident rate. It has been fairly well established by various authorities that the number of accidents is likely to be greater in winter months than in the days of the summer. This has been attributed by some students of the subject to the darker days in winter, but we may add that it is also most likely due to the fact that so many factories have poor artificial lighting that when the days become shorter in the winter, the absence of sufficient daylight makes it impossible for the workmen to move around in the performance of their work with the same ease in the avoidance of obstacles as is the case in the brighter summer days. The available evidence on this point seems to indicate that in those factories where adequate artificial lighting systems are provided, the accident rate will not show this marked tendency to increase during winter months.

Investigations by one of the leading casualty insurance companies has shown further that many accidents which have been investigated are the result of an insufficiency of either natural or artificial light, and these definite cases make the conclusion regarding the importance of the lighting facilities to the accident rate much more tangible than otherwise. We may add, therefore, that it is highly important to furnish aisles and passageways with a sufficient degree of general lighting to make it possible to move about with assurance, and in addition every machine tool or special appliance should have such additional quantities of light that it may be readily possible for the operators to handle the same and to make adjustments without risk of bodily harm.

Accuracy in Production

It is sometimes hard to realize in passing through a plant that with all due care much of the work must be rejected by the inspection department because of imperfections in workmanship. This, of course, holds true even in the well-lighted factory. However, in the shops where the light is far below the minimum intensity dictated by good practice, it follows that the tendency toward inaccuracies will be greatly increased. All such increases in the work which must be discarded due to imperfections and which are traceable to causes of poor light, can thus be added to the arguments in favor of the best lighting system available.

In order to explain this point from a slightly different angle, Figs. 3 and 4 are introduced at this juncture to show just how far good artificial light may go towards a reduction of such losses. Fig. 3 is a day view of a shop where the natural lighting is very poor at all times of the day due to the remoteness of the windows and the very low ceiling over the working area. This view indicates how greatly the shadows may be accentuated due to poor window arrangements. It is easy to see that in such a space the possibility of accurate work is slight unless artificial light is employed to smooth out the dense shadows and to illuminate the space generally. Fig. 4 is a night view in this same section after the installation of a modern system of tungsten lamps, and it will be apparent at once from a comparison of this view with that of Fig. 3 that the conditions of accuracy have been greatly improved by the adoption of the new system of lamps. It is to be noted also that although this section is much improved for night work, it is also similarly improved for day work, and the cost for the lamps and the expense of operating the lighting system, are outlays which will be

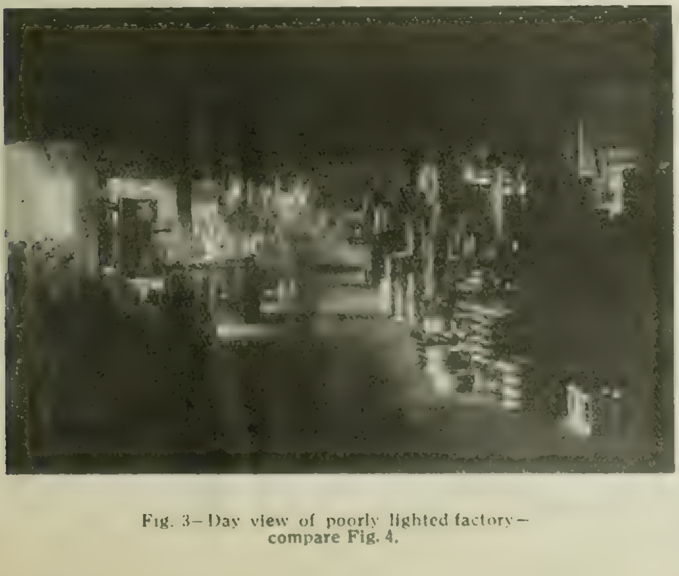


Fig. 3—Day view of poorly lighted factory—compare Fig. 4.

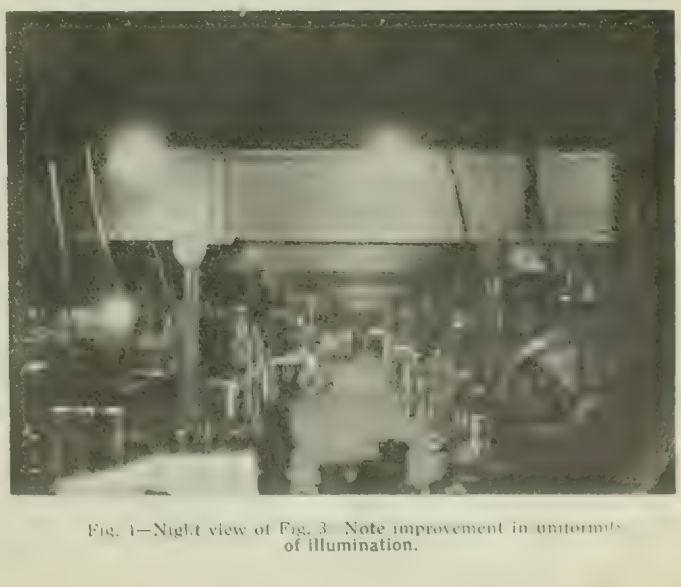


Fig. 4—Night view of Fig. 3. Note improvement in uniformity of illumination.

shown later on to be very small when compared with the savings in time which it affords the employees affected.

Relations to Production

The foregoing notes have touched upon some of the features whereby good light may be classed as an asset to any factory. It is not usually enough, however, merely to tell a manager that the value of the floor space may be increased or that accidents may be reduced by the adoption of better lighting, since these features are more or less general, and what the management of a plant rather desires to know is the cash returns which may be expected if an expenditure is made for the needed changes in the wiring and lamps. In spite of the fact that the figures to show the exact relations between lighting and production are scarce and difficult to gather, there are some more or less definite relations of these two items which may be used to excellent advantage when approaching a factory owner for the purpose of convincing him of the necessity of a new system.

If we take a typical factory bay with dimensions of 16 by 40 ft., the area of this bay will be 640 sq. ft. Under certain practical assumptions as to energy cost and the maintenance of the system, also for the interest and depreciation of the system, the annual gross cost for the lighting in such a bay with a modern system will amount to about $50.00. We may further assume that five workmen will be stationed in such an area, and with practical assumptions as to their wages and the part of the superintendence and overhead charges allotted to this area, the gross wage expense for such a bay may amount to from $5,000 to $7,000 per annum. In such a case it works out that the cost of the lighting will be less than the equivalent of the wages expense for 4 to 6 minutes per day. Similar figures may readily be arrived at on a basis of actual conditions which exist in any given plant.

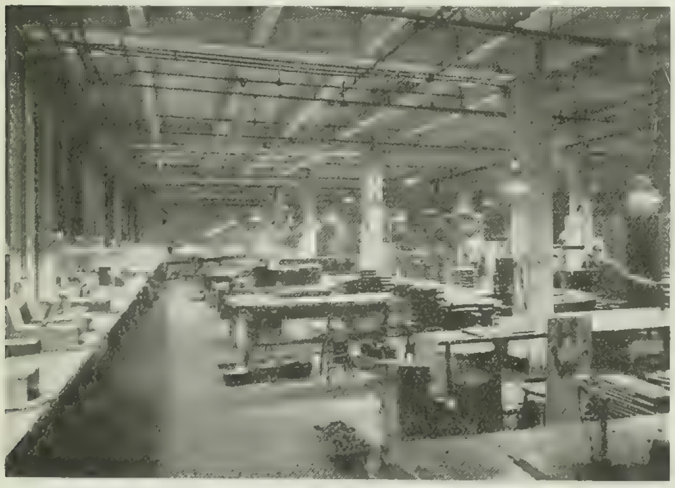


Fig. 5—Mazda B lamps with Benjamin reflectors—Note even distribution of light on bench to left, and freedom from glare throughout.

Probably the most effective way in which to use such figures is to investigate casually the losses which are taking place in the poorly lighted factory. This may be done by inspecting the shop in the early morning and in the late afternoon, and noting the lag in the start of the work in the morning and the tapering off of the work in the afternoon due to poor light in each case. A conference with the foreman or superintendent will also tend to throw additional weight on the evidence. If it is possible, therefore, to show the management that the losses in time due to poor light are on the order of from one to two hours per day, while the cost of the best form of lighting is on the order of from 4 to 6 minutes per day, the tremendous advantage of installing a new lighting system will appeal in nearly every case.

It is interesting to note that actual cases which have come to the attention of the writer, have demonstrated that losses may easily reach a magnitude of one or two hours per day on dark days even where the window arrangements are fairly good, these losses being due to dense fogs or clouds, or often to the very low exterior intensities of natural light during early morning or late afternoon hours of the winter. This general scheme of convincing the management of a plant of the great importance of adequate light to production has been found to be one of the most successful methods of approaching the problem, and a plan which offsets to a considerable extent the lack of more exact data on the savings which may be effected by increased intensities of light as a substitute for formerly insufficient quantities.

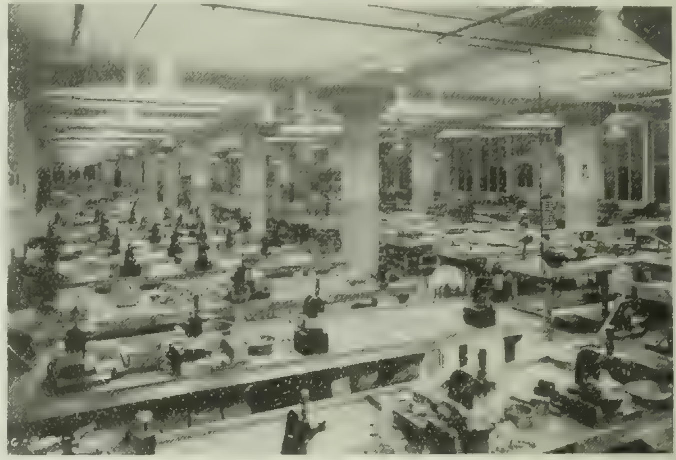


Fig. 6—Indirect system of lighting—Note symmetrical arrangement of units and uniform lighting effect.

Importance of Properly Shielding the Lamps

One of the worst features of the use of modern lamps is the prevalent tendency to install the units without proper reflectors or shades. With lamps of the tungsten type, and more particularly so with the nitrogen-filled type, the bright filament when in the line of vision becomes a menace to eyesight, and moreover, prevents the eyes of employees from performing their functions at the highest efficiency. For this reason, no treatment of factory lighting would be complete unless the importance of such auxiliaries were properly emphasized.

It is to be remembered in this general connection that the use of reflectors and shades have the double function of preventing glare and also of increasing the amount of useful light which is sent downward to the work. Hence, in Fig. 5 it is well to note, first, that the use of tungsten lamps near the work, which would ordinarily be very harmful to the eyesight, is rendered agreeable by the use of suitable metal shades or reflectors, which prevent a workman from looking directly into the bare lamp, and which also re-direct a large percentage of the available light flux from the lamps downward to the working surfaces. This view in Fig. 5 is to be contrasted with that of Fig. 6, in which the inverted or indirect system of illumination is indicated. Fig. 6 shows a system of this kind in use in an industrial building, where the effect of the illumination on the benches is seen to be generally uniform. Of course, in such a case where the filament of the lamp is entirely protected, the tendency to glare effects is correspondingly reduced. The use of the newer nitrogen-filled tungsten lamps with their higher efficiencies has made it possible to use systems of this kind at costs which compare favorably with the direct lighting system of a few years ago where the vacuum tungsten lamp was employed

(To be continued)

Electric appliances in the old farm home, the ideal of every country man—A Waterloo County scene.

Electricity in the Farmers' Homes

The Hydro-electric Power Commission is Doing Splendid Work in the Province of Ontario Adding the Conveniences of the City to the Advantages of Country Life

By E. G. Gurnett

The extraordinary conditions arising from the war in Europe have caused the attention of the whole of Canada to be focussed on the greater production of food products, and during the past season a great effort has been made to increase the acreage under cultivation and improve the quantity and quality of the crops produced.

Owing to the acute labor situation prevailing, and the prospect next year of even greater scarcity of help, everything and anything which can be done to supercede man power by mechanical contrivances is being tried. The farmers of Ontario are doing their share and each district is putting forth a special effort to produce for the present needs of ourselves and the allies. Tractors are being used in many of the counties and the province to-day has ninety of these machines in the fields of Ontario doing fall ploughing and other work.

Those rural districts which are already being served with electric power are now able to fully appreciate the great advantages of the electric motor over other forms of energy, such as steam and gasoline engines, and those districts where lines have not yet been constructed are beginning to realize their need and are taking the necessary steps to have service furnished as soon as possible.

Petitions asking for estimates on the cost of securing service are being received by the Hydro-electric Power Commission over a very extended area covering practically the whole of the province, and it is worthy of note that the Commission is doing something for the farmers in the Province of Ontario that is not being attempted in any other part of the world, that is, the giving of service to them at cost where there are only three consumers per mile.

As an example of the progress which has been made, we might note what has been done in Waterloo Township out of Kitchener and Waterloo. The first service in this district was given in 1914 to Mr. J. Stauffer, Mr. A. Scheiffle, Mr. U. S. Snyder, Mr. N. S. Snyder, and Mr. I. C. Hallman, Mr. E. C. Hallman. These men had already formed a syndicate and were using a threshing machine, an ensilage cutting box and a chopper which were being driven by a steam engine. On their own initiative they had visited Woodstock where there was a syndicate outfit using Hydro power in operation, and on their return, arranged to get service, and purchased an outfit from the Commission for which they paid $1,100. Two more groups on the Waterloo-St. Jacobs Road had been working in syndicates and in 1916, after seeing the results obtained by the men referred to above, arranged to get service and purchased two 20 horsepower syndicate outfits at a cost of $1,350 each, including the following:—

A 20 h.p. motor with starter.

The necessary three transformers so that the outfit would be completely portable.

A meter for recording the current used.

A threshing machine, having capacity of 50 to 80 bushels of oats per hour, fitted with blower, but without automatic feed table and band cutter.

An ensilage cutting box of the blower type, having capacity of about ten tons per hour.

A chopping mill which will grind 60 bushels of oats per hour.

A buzz saw, having a standard frame, such as found in the districts, with 20 to 30 inch blade, according to the desire of the farmer purchasing it.

It will be noted that the cost of this outfit complete would be less than that of a steam engine, and will take care of the needs of from six to ten farmers nicely. In this case they have invested $1,350 as compared with over $3,000 with the usual syndicate outfits.

There are at present nineteen farmers in this district that do all their heavier work with the three 20 h.p. syndicate motors and their light work with smaller motors, including milking, pulping roots, chopping, pumping water, separating cream, besides the use of appliances in the household relieving the heavier work of washing, ironing, sweeping, etc.

The tables below are a report of the work done and the power consumed for domestic purposes and for one of the 20 h.p. syndicate outfits referred to above, from January to December, 1916.

No. 1 Farm

Silo Filling—A 12 x 42 ft. silo was filled 40 ft. settled.

Threshing—2,000 bushels mixed grain; 800 bushels wheat; 300 bushels barley.

Sawed—15 cords (stove length) wood.

Chopped—2,000 bushels grain.

No. 2 Farm

Silo Filling—A 14 x 39 ft. silo was filled 36 ft. settled.

Threshing—1,120 bushels wheat; 1,150 bushels mixed grain; 450 bushels barley; 1,000 bushels oats.

Sawed—12 to 15 cords (stove length) wood.

Chopped—2,400 bushels of grain.

No. 3 Farm

Silo Filling—A 12 x 40 ft. silo was filled and settled and refilled.

Threshing—900 bushels wheat; 1,800 bushels oats; 1,500 bushels mixed grain; 500 bushels barley.

Sawed—12 cords (stove length) wood.

Chopped—3,000 bushels grain in the year.

No. 4 Farm

Silo Filling—Two silos were filled—one 10 x 10 x 22 ft. and one 8 x 10 x 22 ft. Both were filled full.

Threshing—300 bushels wheat; 1,600 bushels oats.

Sawed—(probably wood sawed, but we have no record of it).

Chopped—1,000 bushels grain in the year.

No. 5 Farm

Silo Filling—An 11 x 30 ft. silo was filled and settled.

Threshing—325 bushels wheat; 1,550 bushels oats and mixed grain.

Sawed—16 cords (stove length) wood.

Chopped—1,100 bushels of grain in the year.

No. 6 Farm

Silo Filling—A 14 x 40 ft. silo was filled 24 ft. settled.

Threshing—500 bushels wheat; 2,000 bushels mixed grain, 300 bushels barley.

Sawed—10 cords (stove length) wood.

Chopped—½ day—about 300 bushels—has windmill chopper.

Individual Outfits

The Commission is also giving service to a large number of farmers in the different districts where rural lines have been concentrated who have not combined and purchased [illegible] outfit, but do all the work on their places, in [illegible] and [illegible] with a 5 h.p. motor operated under a 2 h.p. contract. A typical installation of this kind is that on the farm of Mr. D. W. Clark in West Oxford just out of Ingersoll. He has at present belted to a line shaft the following:—

A milking machine.

A cutting box with carrier that is used during the time he is filling silo and disconnected for the balance of the year and used for cutting hay or straw.

A threshing machine, with which he threshes all his own grain, using only his own help. This machine is rated by the manufacturer at 60 bushels of oats per hour.

A pump.

An emery-stone and grindstone.

In addition to this all the buildings are lighted and in the house they use an electric iron, washing machine, a two-burner hot plate and an electric oven.

This farm is taken as typical because it is a moderate size—approximately 90 acres. Mr. Clark is using his power advantageously and the total cost is $96 per year.

Electric washer and iron in kitchen, table stove and electrolier in dining room shown in background.

Methods of Installation

Where a 5 h.p. motor is used, the Commission usually suggest optional methods of installation as follows:—

(a) The motor to be installed in permanent location belted to countershaft which may run the whole length or only part of the length of the barn. To this countershaft would be belted all the machinery that is needed for the place. If it is not possible to get direct belt connection without making too much of a cut in the barn floor, arrangements have been made in some instances whereby a short jack shaft is used, being set on the floor of the barn and belted to the line shaft built so that the belt between the two may be tightened either by leverage or jack screws. To the jack shaft is belted the machine that is to be driven on the barn floor.

(b) The motor may be mounted on a skid or truck with a cable attached, to the end of which is fitted a plug. Receptacles are placed at different stations at which the motor is to be used, with the proper devices in the way of switches, fuses, etc., permanently installed. This method from the point of view of service is not as desirable as method "A," as through carelessness in handling, the attachments and fittings may be put out of business.

Rates and Charges

Under the rates that are in force in rural districts at the present time, the Commission has divided the service into three classes:—

A. Lighting—which is any service up to 2 h.p.

B. Light Power—which is service from 2 to 5 h.p.

C. Heavy Power—which is service from 5 to 10 h.p.

Motor-driven separator and pump on farm of Mr. J. W. Innes

Rural rates are made up of two separate charges, viz., service charge and consumption charge, as follows:—

Service Charge—Three consumers per mile, $3 per month.

Four consumers per mile, $2.50 per month.

Five consumers per mile, $2.00 per month.

The number per mile, being the average in the district.

Consumption Charge—A rate per kw. hour for all consumption used up to the first 60 hours use per month of the contracted amount plus one-half the first rate per kw. hour for all remaining consumption during the month based on the cost of power in the district.

The least amount of power that may be contracted for is 1 h.p., so that a customer having two wire single-phase, 110 volt lighting service would have a 1 h.p. contract.

A large percentage of the consumers wish a three phase, 110 volt power service so that they may install a 5 h.p. motor, but in general use only a 2 h.p. demand.

To meet the demand for this class of power, arrangements have been made to allow a customer who has a 2 h.p. contract to install a 5 h.p. motor and operate it at such times as he may wish, but in cases where such installation is made, the Township reserves the right to install a special motor which will indicate the amount of power taken over the contract amount and the customer would be billed for such excess power at one and one-half times the first consumption rate.

Procedure in Arranging for Hydro Power in Rural Districts

A petition is first to be signed by those wishing a supply of power, and submitted to the Township Council, who will forward it to the Commission, together with a map of the township on which the places of the petitioners have been located.

Locations on the map should be indicated by a small square, inside of which should be placed a number corresponding to the number opposite the name of the signed on the petition.

As it is not always feasible to build lines to supply all the farmers in a township, it should be kept in mind that the Commission does not recommend building lines where the number of customers averages less than three per mile, excepting under special conditions, each of which must be taken up separately.

On receipt of the petitions by the Commission an estimate will be made of the cost of building lines to supply the district covered by the petition.

The Commission, following the estimates made of the cost to supply the district covered by the petition, forwards a definite rate to the Council to be submitted to the petitioners. The Council of the Township then calls a special meeting within one month of the date of receiving the rates, and notifies the petitioners in writing of such meeting in order that they hay have an opportunity of saying whether or not they are desirous of signing contracts for power at the rates submitted.

Contracts are submitted to those who have signed the petition and these must be signed before any construction work is commenced.

The contracts are between the consumer and the Township, and if a sufficient number have been obtained to warrant the construction of the lines the Township Council is requested to enter into a contract with the Commission for the supply of the necessary electric power to serve these customers. This step may be taken by the Council without submitting the question to the ratepayers.

All primary lines are constructed and paid for by the Commission and all secondary construction, which includes the transformers, secondary lines, services for a distance of not more than 120 feet away from the main line, and also meters and the installation of same, are paid for by the Township.

Farmers now pump their water by snapping a switch.

Estimates are prepared to show the Township's share of the cost of construction so that debentures may be issued, and after the construction work is complete, details, showing the cost of material and labor are submitted to the Township Council.

The Township may arrange to operate its own system, but usually it is advisable to have the municipality from whose station the power is supplied operate the system, as it can usually be handled much more cheaply in this way. This arrangement can be made by first getting the consent of the Commission and then passing the necessary resolutions by the Council or local Hydro Commission.

If arrangements are made to have some other municipality operate the system, as suggested above, they would collect all power bills from customers and pay all expense in connection with the operation of the system. They would also pay the Commission for power required to supply the customers and they would pay to the Township Council the annual fixed charges on the Hydro debentures, and pay to the Commission for the Township the annual fixed charges on the investment for the primary lines.

Cost of Construction on the Farm

Assuming that the farmer's barn is 600 feet from the pole line on the road and the house 300 feet distant from the road, the transformers could probably be located close to the barns as that is where the greatest amount of power is used, and secondary wires would be carried back to the house.

With this arrangement we estimate that $46, under normal conditions, would cover the cost to connect up the buildings to give three phase service to the barn in case of any motor from 2 to 5 horsepower, and single phase service to the house.

The cost of interior wiring where wires are concealed and the work is what is known as "knob and tube" work, would be $2.20 to $2·75 per outlet, an outlet being where wires come through the ceiling for a lamp, or through the wall for a switch.

For open work, that is, where wires are not concealed, the cost would be $1.00 to $1.65 per outlet, an outlet being the same as described above.

For conduit work, that is, wires in piping, the cost would be from $3.85 to $5.50 per outlet.

Two horsepower motors cost approximately $145 for three phase, 25 cycle, and 5 horsepower, three phase, 25 cycle approximately $198.

The following is an example of what the cost might be of wiring a farmer's house and barn:

In the House

10 lights on two switches at $2.75 per outlet	$ 33.00

In the Barn

6 lights on three switches at $1.50 per outlet	10.50
1 outside light on corner of drive shed or other convenient building, so as to light yard	3.00
Service entrance	5.00
17 lamps at 35c each	5·95
Lines into premises as noted above	46.00
Total	$133.45

From the above figures estimates can be made of almost any combination of lighting that farmers may wish.

Filling the silo with portable motor-transformer outfit.

It must be kept in mind that the above prices are only approximate, as the cost of material is changing from time to time, and the cost of labor varies considerably in the different districts.

Information regarding rural power will be supplied by the Commission on application.

WATERLOO TOWNSHIP SYNDICATE

Uses of Power for Domestic and Power Purposes

Rate – Service charge $30.00. Power 4c. per K.W.H.
Discount 10% for prompt payment from power only

Farm No.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Domestic	Power	Serv. charge	Total
						K.W.H.											
1	48	35	28	33	21	17	20	30	33	38	59	47	409	$14.72	$43.96	$31.66	$90.34
2	48	31	23	23	29	55	17	19	25	36	51	54	411	14.80	56.52	30.00	101.32
3	39	49	33	18	10	10	13	12	19	23	36	33	295	10.62	54.68	30.00	99.30
4	31	27	21	23	14	15	16	15	20	38	56	25	182	6.55	31.57	30.00	68.12
5	31	26	23	18	12	12	10	15	21	23	35	43	319	10.48	29.84	31.66	71.98
6	45	17	13	12	6	6	7	13	15	16	7	25	182	6.55	31.57	30.00	68.12
7	On Town System		..	..	..	..	..	..	..	..	..	..	...	.....	13·57	9.00	22.57
													1,869	$66.28	$259.30	$192.32	$521.90

Power Used by 20 H.P. Syndicate Outfit

1	73	..	.	34	..	..	..	283	...	153	30	648	1,221	$43.96	
2	58	..	42	26	59	32	12	131	192	185	745	88	1,570	56.52	
3	67	.	51	42	10	19	..	89	289	228	267	457	1,519	54.68	
4	76	.	71	..	.	.	26	107	134	..	363	52	829	29.84	No record of detail work done
5	65	.	.	49	20	.	..	51	245	...	312	68	810	29.16	
6	.		..	..	.	.	..	..	193	114	21	519	847	31.57	
7	.		.			.	..	260	...	117	...	.	377	13.57	
													7,203		
													9,072		

Note.—Nos. 1 and 4 now pay an extra service charge of $5.00 per year from September 1 to December 30

Average cost per kilowatt hour including Service Charge:—

No. 1	5.542 cents
No. 2	5.114 cents
No. 3	5.48 cents
No. 4	6.27 cents
No. 5	6.42 cents
No. 6	6.528 cents
No. 7	6.00 cents

Calgary Power Company's Annual Report

A recent statement of the Calgary Power Company, Limited, shows the earnings for 1916 somewhat below those of the previous year, but still well above the level of 1914. The gross is $266,982, the net from operation, $217,058, and the profit after fixed charges, $65,209. These figures show respective decreases of $22,631, $20,100, and $14,983. Of the net profit of $65,209 for the year, the company applied $60,000 to writing off discount on bonds and to depreciation, leaving the net surplus carried forward at the end of the year $107,735, against $102,526 the previous year. The surplus revenue of the year wiped out most of the company's floating indebtedness. Bank loans, which were $90,500 a year before, are reduced to $25,000, and the only other item of liability except to bond and stock holders is $12,924 in accounts payable. In cash, stores and accounts receivable the company has current assets of $41,622. In his report, as president, Mr. R. B. Bennett takes up the question of the company's contract with the city, which terminates in December, 1918. The city has the option of renewing the contract for an additional term of five years, notice of renewal to be given on or before December 1 of the present year. The minimum amount payable to the company under the contract is $130,000 a year, being for 5,000 horse power at $26 per h.p. For the next 5,000 h.p. the city has contracted to pay on a scale down from $25 to $21 per h.p., and for all over 10,000 the rate is $20. The president notes, however, that "the city has from time to time endeavored to induce the company, notwithstanding the terms of the contract, to supply power in excess of the fixed 5,000 h.p. during the summer months, when the water was high, at $15 or less, per h.p." The company does not propose to depart from the terms of the contract, and the question of the city exercising its option of renewal of the contract therefore appears to be uncertain, particularly as the city owns and operates a steam plant capable of supplying its entire electric light and power requirements. The one-year contract by which the power company assumed responsibility for the operation of the city's steam plant, as an auxiliary, expired on May 1 last and was not renewed. While the question of a further contract remains in abeyance, the city's demands for power are increasing. Another 1,000 h.p. will probably be taken, which at $25 per h.p., will provide an annual revenue of $25,000 in addition to the minimum of $130,000. In view of this expected increase, the directors state that additional expenditures for transformers and other equipment will be necessary at an early date.

P. T. Davies Goes to Southern Canada Power Co.

Mr. P. T. Davies has resigned the position of manager of the Power Sales Department of the Montreal Light, Heat & Power Company, and has accepted a position with the Southern Canada Power Company, Montreal, as the manager of the new business department. He is succeeded in the Montreal Light, Heat & Power Company by Mr. W. O'Brien. The testing department of that company, hitherto incorporated in the power sales department, will be included in the testing and inspection service department under the management of Mr. J. A. Beaudin and superintendence of Messrs. E. Craig and W. A. Walker. The testing and inspection service department, mainly composed of elements now segregated in various departments, is to be organized under the direction of the service, complaint and record departments, to take care of service transfers, periodic re-inspection, and new service inspections.

Sir Adam Beck recently laid the corner stone of the new office building which is being erected at the corner of Dundas and Wellington streets for the Public Utilities Commission.

Hydro Station for New Toronto

Building operations were recently commenced on the new hydro-electric sub-station at the corner of Ninth Street and Birmingham Ave., by Witchall & Son, the contractors, who aim to have the building completed before the winter. It will be a three-storey structure of pressed brick, steel and concrete, costing, with equipment, $80,000. Indiana ornamental stone will be used for trimming. As a power station, the Hydro officials state it will be one of the most modern in Ontario, with a capacity of 4,000 h.p., which may be doubled should the industrial growth of New Toronto require it.

Personals

Mr. H. W. Foulds, formerly of the Montreal staff of the Southern Canada Power Company, has resigned to join the American army.

Mr. M. W. Kirkwood, former general superintendent of the G. P. & H., and L. E. & N. Railways, has been promoted to be general manager of the two roads.

Mr. D. W. Houston, superintendent in charge of construction and maintenance, Regina Municipal Railway, has been elected an associate member of the Canadian Society of Civil Engineers.

Mr. R. N. Coke, now "somewhere in France," but formerly with the Winnipeg Light & Power Company and Northern Ontario Light & Power Company, has been elected a junior member of the Canadian Society of Civil Engineers.

Mr. C. B. Archibald, elected an associate member of the Canadian Society of Civil Engineers, is chief engineer of the Nova Scotia Steel and Coal Company, in charge of the civil, mechanical, and electrical department, West Wabana, Newfoundland.

Mr. Wilford Phillips, who has occupied the position of general manager of the Winnipeg Electric Railway Company for some fifteen years, is retiring. Mr. Phillips has not been in the best of health for some time and last year was granted very considerable leave of absence on this account.

Mr. Edward D. McCormack, for many years manager of the supply department of the Canadian General Electric Company, has established an electrical brokerage business with offices in the Bank of Hamilton Building, Toronto, and will execute commissions in connection with the buying or selling of electrical appliances and supplies, construction material, etc. Mr. McCormack's personal attention will be given to all enquiries and orders.

Mr. A. W. McLimont has been appointed the general manager of the Winnipeg Electric Railway Company, succeeding Mr. Wilford Phillips. Mr. McLimont was born in the city of Quebec, but has spent most of his life in electric railway work in the United States, particularly in connection with the Chicago and Milwaukee Electric Railway System. Latterly he was with the Michigan United Railway System.

Mr. M. M. Todd, third son of the late Martin N. Todd, has been elected to succeed his father as president of the Galt, Preston & Hespeler Railway, and vice-president of the Lake Erie & Northern Railway. Mr. Todd represents the third generation of the Todd family to hold the presidency of the G. P. & H. Railway, his grandfather having been one of the promoters of the line and its first president. He is twenty-four years of age, and, we believe, the youngest railroad president in Canada.

All authorized employees of the Toronto Hydro-electric Commission are provided with numbered badges bearing the word "Hydro." This is to identify bona fide employees of the Commission and prevent unauthorized visits to the houses of consumers.

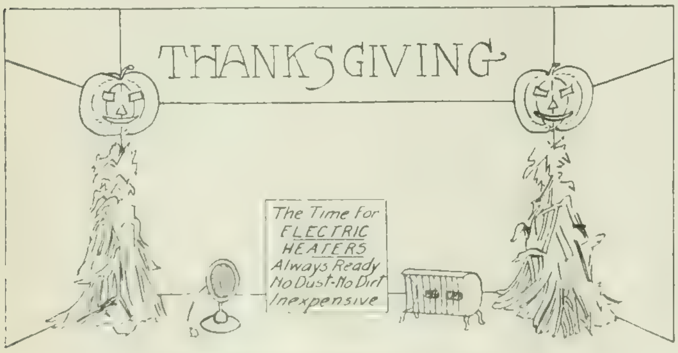
The Dealer and Contractor

The Public is Watching Your Show Window—They Judge Your Business by it, Whether You Are Progressive or "Slow"—Change Your Display Often

There are certain well known requirements of the attractive show window—cleanliness, seasonableness, frequent changes, etc. The last is very important. The average run of street shoppers will not stop to look at the same window more than a couple of times any more than they will go repeatedly to see the same "movie." Their curiosity, or, if you like, their thirst for information, demands something new. Many of our large general stores change their window displays every day. Electric stores may not find this profitable yet, but it has been amply demonstrated that once a week is none too often, and every other day is better. This applies, of course, to larger and more thickly populated centres. A town dealer may not need such frequent change.

But just in proportion as the town dealer has less need for daily change in his window display he should exercise greater care to make each exhibit of such attractive design and individuality that it will be talked about. "Have you seen Mr. Watt's window this week?" should be the standard question asked about the town dealer. No other kind of advertising could possibly be so valuable.

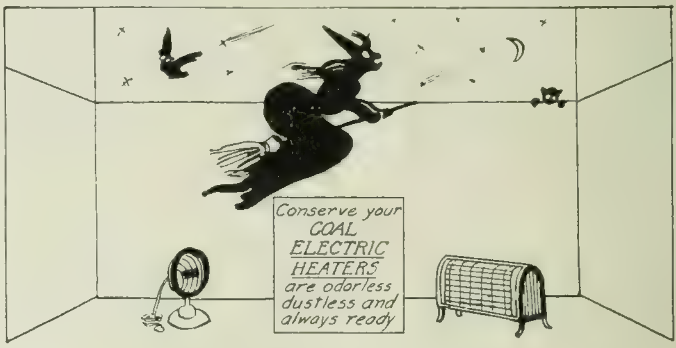
Perhaps the average electrical dealer does not realize the infinite advantages he possesses over dealers in other lines for making his displays attractive. Light, plenty of light and properly arranged, is one of the first essentials. The electric dealer not only has the necessary equipment, but he knows how to use it to the best advantage. Added to this his merchandise can always be shown in a more or less spectacular manner, full of life and warmth.



Suggested window display for October

Another reason why the electrical window should be the most attractive in any locality is that the contractor or dealer may profit by this example with other retailers. No retailer wants to see the other fellow's window the centre of attraction at the expense of his own. So the attractive electric display will bring requests for the equipment to make other windows equally attractive.

The timeliness or seasonableness of the window display plays, of course, a very considerable part in its "pulling" power. The average householder is not much interested in fans during the months of January and February. Each month has its special demands. For example, during the month of October, the average householder in these times of thrift is figuring how he can hold off that unpleasant annual event of starting up his coal furnace. This is the time, therefore, to drive home the valuable features of electric heating. Explain that a few cents in electric current makes the sitting room cosy at night at a fraction of the expense of coal. Dilate also on the cleanliness and entire lack of labor where the electric is concerned. A few actual figures showing the relative cost of the electric vs. the coal or wood fireplace works out decidedly to the advantage of the former under average rates. For example, a coal fireplace can scarcely be lighted even for short evening use with a consumption of less than 20 pounds of fuel. At $10.00 this is an actual expenditure of 10c. Added to this there is the labor of removing the ashes, cleaning the grate and hearth, resetting the fire and generally speaking, the housecleaning of the whole room. Contrast with this the cost of operating, say, a 1,000-watt heater, or less, for one, two or three hours, that is, one two or three cents in many localities, and in very few towns or cities would it be greater than the coal cost—and in addition to this there is no labor and no dirt.



Portable heaters will sell this month.

So October should be the month for showing and demonstrating heaters of various types. Make it plain to the customer at once that all are equally efficient, practically 100 per cent. The difference is chiefly in design, so that the buyer is free to make his choice.

There are many other things that may be advertised in October—better lighting for the lengthening evenings, vacuum cleaners for the fall house cleaning, and so on, but these could be held for another season. It is well to concentrate on one item at a time and that one item for the present month seems to be "heaters."

Perhaps the accompanying designs may prove helpful to the window dresser for his October display. They are simple to install and may be varied at will. In view of the coal shortage and high proces especially, try what an October campaign of this nature will bring you. The facts are on the side of electric heating. Drive these facts home to your own financial gain and the added comfort and satisfaction of your customer.

Toronto Electric Contractors' Association

Notices have been sent out by the secretary of the Toronto Electrical Contractors' Association, Mr. J. Everard Myers, calling the members together for their first regular evening dinner, which will be held at the Carls-Rite, as usual, at 7.30 p.m. sharp, on Thursday, October 4. The notice states that officers and members alike are expected to return to these gatherings with renewed interest and vigor and to assist, by regular attendance and intelligent discussion, in carrying forward the programme which has been outlined for the fall and winter months.

Toronto contractors will do well to start the season right by attending this first evening dinner. It will take a little effort but that will be forgotten in the pleasure and profit of spending the evening together with your co-workers. A number of points will be discussed of mutual interest, and the viewpoint of every man in the business is required. So be on hand promptly at 7.30 p.m. sharp, Carls-Rite, Thursday, October 4.

How About This?

Editor, Electrical News:

As I understand your next issue is to be devoted largely to electrical domestic appliances and lighting equipment, perhaps you will be good enough to allow me a small space to express the opinion of an electrical contractor who is none too well satisfied with the conditions under which these appliances are marketed in this country.

To begin with, let me ask the question—why is it that one of the most favored (among contractors) lines of household appliances is one made by a foreign firm? We have plenty of Canadian articles—why are these less popular with contractors?

Having asked this question, I would like to give you my answer to it—as I see it the reason is:

1. We contractors never know where we stand with many Canadian manufacturers. We buy articles to sell at such and such prices, only to find that others are underselling us on the same article. Not infrequently our own customers go over our heads direct to the manufacturer and buy the article for the same price given the contractor. In a word, there is no effort made to maintain a fair resale price. This in the main explains why contractors are lukewarm for these manufacturers, and,

2. The service we get is often not satisfactory. Contractors are going to sell those articles that give them the least trouble. This means even more than profit. We want the manufacturer who stands back of his goods, and promptly, at that. Our bread and butter depends on satisfying our customers. That is quite impossible unless some of our manufacturers give us better backing.

It is in these two things that the foreign firm I mentioned above excels. We know that the retail price of any article we buy is not varied to suit circumstances. We know this firm will stand behind us promptly with their guarantees. We can send our customers direct to these people with their complaints and feel perfectly sure they will leave with a friendly feeling towards the company, and, more important still, towards us.

Now I may be all wrong, but it does seem to me that the Canadian manufacturer makes a big mistake when he ignores the viewpoint of the electrical contractor. In one sense, we don't care there is as much in one as the other but for patriotic reasons we would all rather patronize home industries. We won't stand for having the Canadian manufacturers capitalize our loyalty, however, for their own dividend purposes. We want fair treatment and will deal with the firm that gives it to us in biggest measure.

It may be that I am wrong in all this, but, if so, I want to be shown. I do know that it is the viewpoint of electrical contractors in general. They want to be loyal to Canadian apparatus, but don't get a fair chance. Perhaps this will start a discussion that may lead to something. If so, I shall be one of the first to swear allegiance to "home-brews."

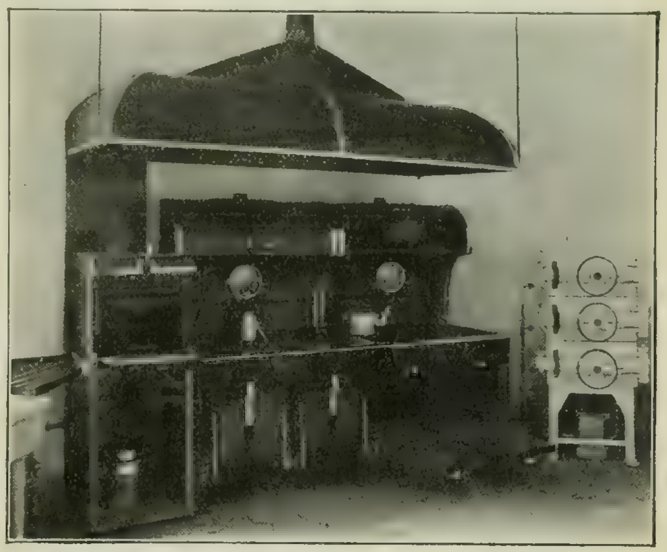
Yours truly,

"Electrical Contractor."

Examples of Electric Kitchens

A number of hospitals, hotels, cafeterias, restaurants and other institutions are rapidly adopting the all-electric kitchen because of its many advantages, including the improved sanitary conditions which result.

Fig. 1 shows an installation of Canadian General Electric broiler and two electric ranges at the King George Hospital, Winnipeg, Man. This range, as illustrated, has been found to have sufficient capacity for all requirements of two hundred patients and employees.



Electric range in King George Hospital, Winnipeg.

Fig. 2 shows a recent date C.G.E. D-77 Hotel Type range section installed in the kitchen of the Hydro-electric Power Commission Building, Toronto, on which the noon-day meal is prepared for the staff.

Fig. 3 shows another C.G.E. installation at the cafeteria, Port Stanley, Ont. This place makes a good advertising feature of the fact that all the cooking is done electrically.

A still more recent convert to the electrical method of cooking is the Queen Alexandra Hospital, London, Ont. This installation is just being taken care of at the present time.

A few months ago a prominent club in Boston was considering the question of adopting electric cooking apparatus in the restaurant, and an investigation was made to ascertain the cost of cooking with various fuels and with electricity. Briefly the data obtained was as follows:—A club kitchen using an electric range and bake oven and having steam heated stock kettle and serving table showed that electricity at 3c. per kw.h. would compete with coal at $7.50 a ton or with gas at $1.00 per thousand feet. The lowest cost per person per meal was reported by a club doing all cooking on a coal range—the figure being $.007. The highest cost was in a club using coal, charcoal and gas the figure being $.017 The two other clubs gave $.0112 and $.1101 respectively.

Operating data in the dietary kitchen of a large hospital was furnished some time ago, and a summary of the important factors obtained from the operation of the electrical equipment is given below:—

Range installed in Hydro Building, University Ave., Toronto.

Month	Total Kw.	Avg. Kw. per day	Avg No. of patients per day	Person meals	Kw. per person per meal
July . .	1160.3	46.6	12.7	967	1.20
Aug. . .	1523.8	49.1	9.6	880	1.73
Sept. . .	1255.9	41.8	12.4	1160	1.08
Oct. . .	1627.8	52.2	20.1	1890	.86

It is interesting to note the resultant increased economy of operation as the operator became more expert in the use of the apparatus. This is especially noticeable in view of the fact that considerably more cooking was done in October than previously, although no record was maintained of the custards, etc., which were cooked for the ward patients.

Hotel type range in cafeteria, Port Stanley, Ont

The hot plates of the range are rugged and efficient and are made by pouring moulten iron around a sheathed wire winding so that they provide self-contained units with perfect heat conduction and distribution. They are stronger than the old-time stove lids, as they are reinforced with a cast-in wire and will not warp or crack.

The range front and door frames are heavy steel plate. The oven walls have efficient heat insulation. The range is surmounted by a high bank of sheet metal with a shelf 13 ins. in depth.

All heating units are of sheathed wire and may be readily removed for cleaning. Each unit is protected by fuses and is controlled by lever knife switches mounted in a switchboard at the side of the range. The main circuit is also protected by a double pole circuit breaker.

The equipment for one range section is as follows:—

Two 18 by 18 by 26½ in. roasting ovens—

Lower units, 2 heats	1000-2000 watts each
Upper units, 2 heats	500-1000 watts each

Two 9 by 12 in. hot plates—

4 front plates, 1 heat	1600 watts each
4 rear plates, 1 heat	800 watts each

	Dimensions (inches)		
	Height	Width	Depth
Ovens, inside	18	18	26½
Hot plates		9	12
Cooking top	33	37	24
Shelf	8	43	12
Overall	61	48	39½

Six and a Half Pounds of Electrical Information

The new general supply catalogue just issued by the Northern Electric Company, Limited, is a compliment to the electrical business of Canada. The book, which is one of the largest electrical catalogues issued on the continent, contains no less than 1,485 pages, and weighs 6½ pounds ready for mailing. It contains the most complete listing of up-to-date electrical specialties of every description, classified in twenty-two sections, each section commencing with a four-page colored insert printed on heavy coated paper.

Some idea of the material covered by this book may be had from the titles which have been assigned to the various sections, as follows:—(1) Telephone Section; (2) Wires and Cables; (3) Pole Line Hardware; (4) Insulators; (5) Tools and Construction Appliances; (6) Insulating Materials; (7) Conduit and Conduit Fittings; (8) Small Electric Light Wiring Devices; (9) Fuses and Knife Switches; (10) Lighting Fixtures and Accessories; (11) Socket Devices, Electric Ranges and Fans; (12) Light Sources and Applications; (13) House Goods, Novelties and Flashlights; (14) Batteries and Accesories; (15) Switchboards and Panelboards; (16) Protective and Power Control Devices; (17) Indicating, Recording, Integrating and Testing Meters; (18) Generators, Motors, Transformers and Motor Appliances; (19) Low Voltage Outfits; (20) Railway Electrical Supplies; (21) Automobile Electrical Devices and Accessories; (22) Miscellaneous.

This catalogue contains many improvements and innovations over previous issues, but the big improvement in this issue is the method provided wherever practicable whereby prices f.o.b. Halifax, Montreal, Toronto, Winnipeg, Calgary and Vancouver can quickly and easily be obtained. Electrical supply catalogues as heretofore issued, have given only the manufacturers' list prices and discounts, usually making it necessary for the purchaser to estimate his own freight (or freight and duty) where costs were required f.o.b. various destinations. In this catalogue, the Northern Electric Company have taken care of these two very important elements entering into the cost of electrical supplies delivered to Canadian points. To accomplish this, they have used Montreal and Toronto as basing points and the list prices found in the catalogue apply to goods sold f.o.b. Montreal or Toronto (except in cases so noted). For other points at which the company has warehouses, the approximate delivered prices can be obtained by adding to the list prices shown, the necessary percentage as explained in footnote on each page.

King George Visiting Vickers Plant

The King of England has shown the deepest interest in the labor conditions under which munition workers at the various points in his realm operate, as shown by the accompanying photograph, which illustrates his reception at a recent visit he made to one of the Vickers' munition factories. The picture is a striking tribute to the fact that both sexes of all ages are straining every effort to bring our great struggle to a successful termination.

The King's reception by women workers at a Vickers factory.

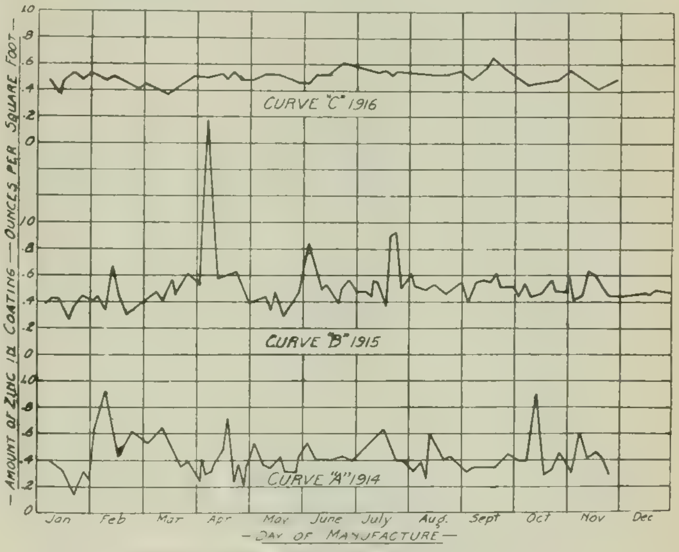
Underwriters' Laboratories' Service for Rigid Conduit

The curves shown in the accompanying chart are illustrative of a feature of the Factory Inspection and Label Service of Underwriters' Laboratories of which many who do not make use of labels regularly are not informed. Many property owners, architects, contractors and inspectors know of the "Underwriters' Label" only as a means of identification of goods which have been examined and tested at factories and found to be standard. While this is the principal as well as the original function of the label, the service delivered by Underwriters' Laboratories is, wherever possible, planned to secure results in many ways of benefit to the users of labeled material as well as to the manufacturers of appliances and materials. In the electrical field in particular this service feature has seen great development. The curves herewith demonstrate this feature for rigid conduit.

The efficiency of the zinc coatings on conduits in protecting the steel tube from corrosion is, of course, dependent upon the thickness of the coating and its uniformity. In the Label Service Procedure for this product it is provided that, in addition to the tests made by inspectors at the factories specimens representative of the daily output shall be taken by the inspector and forwarded to the Laboratories' main testing station in Chicago. These specimens are promptly subjected to quantitative analyses for amount of zinc in the coating and for uniformity in thickness. The results of these tests are immediately reported to the manufacturer with the history of the specimen. Study of these reports permits of necessary modification of factory methods to avoid excessive variation as well as substandard product. Persistant attention to metallic coating machine operation based on such accurate data makes possible astonishing improvements in the course of time.

Curve A shows the variation from day to day in amount of zinc in the coatings of specimens from one particular factory's output during 1914. There are a number of points in this curve which show that coatings for these specimens were very thin. Other specimens had excessive amounts. Curve B is the 1915 record for the same factory. While wide variations in amounts of zinc in the coating appear it may be seen that a minimum amount of one quarter ounce per square foot is exceeded.

The 1916 record, Curve C, fully demonstrates the manufacturer's success in securing control of the process as the result of intelligent study of the reports regularly received from the Laboratories. It is of further interest that the total quantity of zinc used for the output for 1916 is only slightly, if at all, in excess of the amount used in the previous years, while the service value to the user, especially from the point of view of resistance to corrosion, is materially increased.



Graphic results of tests made by Laboratories.

There are many instances of such results from co-operation between Underwriters' Laboratories and manufacturers subscribing to the Service of Inspections at Factories and Labeling.

The cheery Trumbull Tem, in Sept. "Trumbull Cheer," has a few pithy remarks about pacifists. In his opinion, "a pacifist bears the same relation to a German propagandist as a fool bears to a villain." And he goes on to ask, "is there a man in the electrical industry we love and serve, whose voice and soul is not true to his country's call and need? If such there be, I devoutly hope he will never disgrace a 'Circle T' switch with his contaminating fingers." This is putting patriotism before business. Would that some of our politicians could be imbued with the same spirit!

We are advised that effective Saturday, September 15th, the prices on Hubbell reflectors, listed under Schedule "C" advanced approximately 10 per cent.

Rose & O'Hearn Move to Larger Quarters

Mr. Fred Rose and Mr. J. J. O'Hearn, who, under the firm name of Rose & O'Hearn, started in the electrical supply business a few months ago on Victoria Street, Toronto, have quite recently, owing to the expansion of their business, found it necessary to remove to larger warehouse and office premises and are now located at 220 King Street West. Both Mr. Rose and Mr. O'Hearn are well known to the electrical trade through their long connection with the Canadian General Electric Company, Mr. Rose having covered Western Ontario for the C. G. E. for sixteen years, while Mr. O'Hearn was, for several years, Fort William representative of the company, and latterly was with the London office. They are now representing several well-known Canadian and United States electrical manufacturers and are in a position to supply anything in the electrical supply line. With the improved facilities they now enjoy in their new premises they are in a position to supply the trade promptly and pride themselves on filling and shipping all orders complete the same day they are received.

Chicago Office for Sangamo

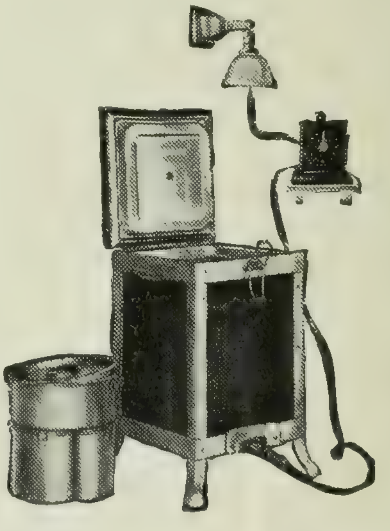
The Sangamo Electric Company announce the opening of a Chicago District Office in the Old Colony Building, in charge of Mr. C. H. Hurtt as district manager. For several years past the Sangamo Company has had a Chicago representative located with the Electric Appliance Company, for many years selling agents for the Sangamo Electric Company throughout the middle west. In establishing this new office, the Sangamo Company has made no change in the selling arrangements which it has had for many years with the Electric Appliance Company and the Federal Sign System (Electric) of Chicago, who will continue to handle Sangamo products exactly as in the past. The new office has been established with a view to giving a more complete service on Sangamo meters and other products than has heretofore been possible in Chicago and surrounding territory; this being necessary on account of the greatly increased demand for Sangamo products. A completely equipped repair department will be maintained as heretofore, under the management of the Chicago office.

An unusually graceful design of fixture made by Tallman Brass & Metal Co.

An Electric Fireless Cooker

The fireless cooker has long appealed to economically inclined householders as the best method of keeping down fuel bills, but the inconvenience of removing, heating and replacing the soapstone discs has more than offset the advantages of reduced cost. The discs remain hot, too, for only a limited time—frequently not sufficient to properly cook the article concerned. The electric way has once again solved the difficulty, so that we can now have the economy and efficiency of the fireless cooker coupled with all the luxury of electrical operation.

The necessary qualities are all combined in a new electric cooker that has recently been perfected by the Standard Electric Stove Company, of Toledo. Cooking is done by retaining the heat on the fireless cooker principle, but instead of having to remove the disc and heat it and replace it when hot, all you have to do is turn a switch which connects up a 640-watt element embedded in a calorator which occupies the place of the soapstone. When sufficient heat has been developed to raise the temperature of the cooker to the necessary point, a second advantage over the soapstone heater comes into play; instead of the heat being entirely cut off, a sufficient amount is developed by a 40-watt element to keep the temperature high enough for cooking for any length of time.



Another feature about this stove is an automatic clock set. Having judged the length of time required to heat the cooker and contents with the 640-watt heat, ten or fifteen minutes, as the case may be, you set your clock correspondingly, and when this time has elapsed the clock automatically switches off the 640-watt element and switches on the 40-watt element. The low cost of operation of this small heater may well be understood when it is considered that it would consume only 400 watts in cooking oatmeal porridge, for example, over a ten-hour night, which, at the rate obtaining at many points in Canada, would cost considerably less than one-half cent.

This cooker has really been in the making since 1910, but has been improved from time to time until it seems that now an article has arrived which has long been needed. The cooker may be attached in the usual cord attachment manner to an ordinary electric lamp socket.

New Benjamin Lighting Unit

A new lighting unit has been brought out by the Benjamin Electric Manufacturing Company of Canada, known as the "No. 786 X." This unit is designed for use with 200-watt lamps, although a minor detail of adjustment fits it for other sizes, as small as 25 watts. The reflector is 10⅝ in. and it and the hood are of one piece of special heavy gauge steel. The unit is well ventilated, having the holes protected by a steel hood. Loss of light in the hood is reduced to the minimum, as the entire interior is heavy porcelain enamelled in white; the outside finish is black. A heavy porcelain socket is used with lamp grip and a special waterproof suspension is provided which includes a porcelain strain insulator. The opal ball globe is 6⅝ in. by 5¾ in. and is supplied with a ventilated open bottom. The reflector is cleverly designed to permit this globe to fit up into it in such a way as to prevent all rain or sleet from drifting in upon the lamp. The unit is thus suitable for abattoirs or under similar conditions where the atmosphere is almost continuously laden with an excess of moisture. The manufacturers believe that the design, size and mechanical perfection of this unit make it very attractive and are preparing for a heavy demand.

Benjamin 786-X.

Better Illumination of Industrial Plants

The industrial world is facing the problem of how to increase production. Many plants, such as steel mills, are compelled by the nature of their product, to operate both night and day, even in normal times. Others, which run only by day ordinarily, must either increase their factory space, or add a night shift. In most cases the night shift offers the most simple and economical method of increasing production. But there are many industries, dependent on accurate workmanship, which have found it impossible to maintain a high standard of quality in products manufactured at night. Almost always, in such cases, faulty lighting has been the cause of failure; and unless a satisfactory system of illumination can be introduced in such plants, the only way to materially increase production is to provide new buildings so that all work may be done by daylight.

To take care of conditions like this, and to make it possible to produce as good work by night as by day, the Ivanhoe system of Reflecto-Cap Diffusion has been developed by the Canadian General Electric Company. The diffuser consists of a twenty-inch steel reflector (finished with green porcelain enamel on the outside, and white porcelain on the inside) and a silver plated cap highly polished on the inside, and provided with a wire spring holder for attaching it to the bulb of a 200 watt Mazda C lamp. The construction is shown in Fig. 2 as follows:—A, ½-inch tap; B, porcelain enamel holder; C, porcelain socket; D, porcelain enamel reflector; E, wire spring holder for cap; F, internally polished silver cap. Direct glare is done away with by covering the lower part of the bulb of the 200 watt lamp with a silver plated cap. This cap hides the filament from the eye, and directs the rays of light to the large reflector above.

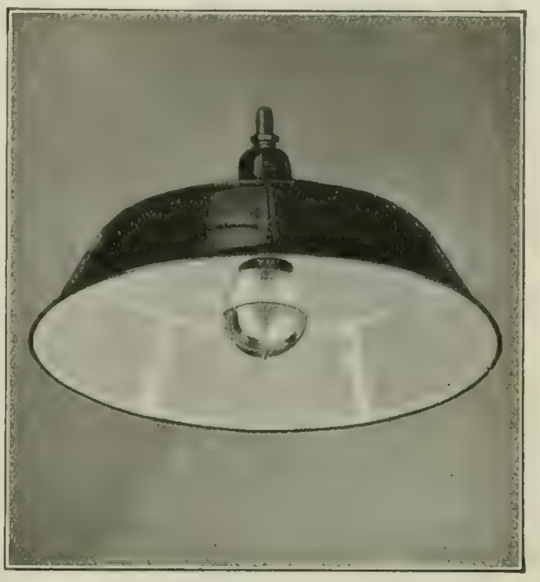


Fig. 1—Reflecto-Cap fixture.

The light is distributed evenly over the entire surface of the reflector, so that it is possible to view the unit from any direction without discomfort to the eyes; the size and shape of the reflector have been scientifically determined to give a thorough diffusion of light, and thus get rid of reflected glare from shiny objects in the working-plane. The net result of illumination with this new system is that the eyes can perform their tasks at all times without any discomfort, because all objects are evenly and softly illuminated. When it is considered that a mere glance at a glaring source of light may impair the workman's vision for a period of minutes, thus increasing his liability to make improper machine adjustments, and thereby spoiling his work, it becomes evident that better factory lighting is not only a conserver of the human eye, but of time, material, and profits as well.

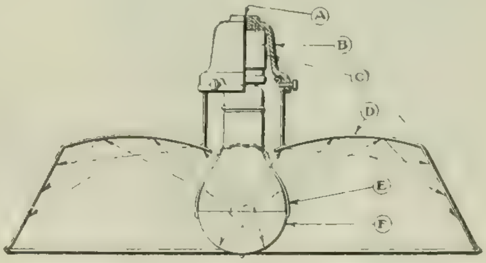
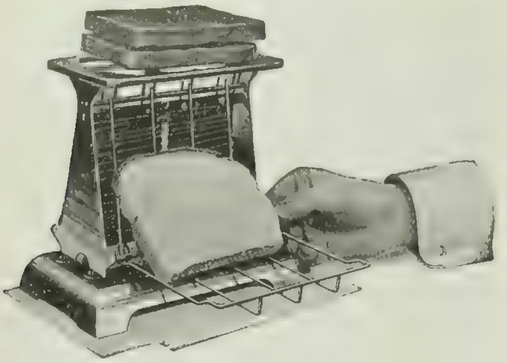


Fig. 2—Construction of Reflecto-Cap.

Induction Motors Bulletin 182, by the Crocker Wheeler Company, describing Form P. induction motors, squirrel-cage type, 60 cycle, [illegible] to 3 h.p.; well illustrated.

The "Turn-over" Toaster

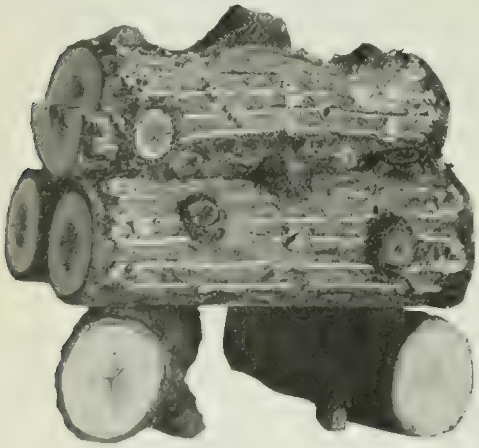
The Westinghouse "turn-over" toaster, illustrated, is one of the handiest types of this household appliance that has been placed on the market. You simply place a piece of bread on the tray, turn the knob to the right and one side begins to toast. Turning the knob to the left swings the tray down and allows the low end of the bread to slide down to the top of the tray; this is the operation which turns the toast. Turning the knob to the right again brings the untoasted side up against the heat. Turning the knob again to the left brings the completely toasted bread down to the tray, from which it may be removed without danger of burning the fingers.



The toast slides down the tray.

Electric Log Fires

Something quite new in electric heaters has been designed, and is already being marketed, by the Claywood Electric Company, 1-3 Jarvis Street, Toronto. These are known as electric log fires, one design of which is illustrated herewith. These fires are made in a number of forms and are at the same time artistic, clean, odorless, economical and safe. They are a very excellent representation of actual logs burning, this effect being produced by running the wires along the cracks in the bark of the logs. The logs shown have base logs, but may, instead, be set on andirons. These produce a very pretty effect indeed. The Claywood Company have a number of designs of logs, portable and otherwise, and electric coal fires which utilize the baskets which most householders already use for coal or wood. They also manufacture to special and exclusive designs to meet the requirements of the man or woman who wants something "different." Capacities range from 1 to 3 kilowatts. The various designs have been tested and approved by the Hydro laboratories.



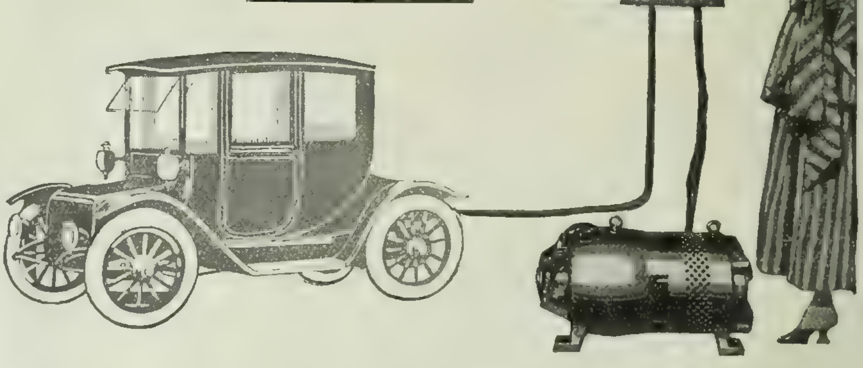
Clean, safe and attractive.

Charging the Electric at Home

Much of the advantage of the electric vehicle lies in the fact that it is trouble proof, in which respect it compares very favorably with the gasoline car. As a matter of fact, there is nothing in the machinery to get out of order except the batteries, and the worst they can do is to become discharged at an inopportune moment. The possibility of this becomes most remote if the owner has complete charge of the car and so can determine the mileage that the car is capable of at any hour of the day without further charging. It follows, therefore, that the most supreme satisfaction is obtained from the electric when the cells are charged under the direct supervision of the person who drives the car.

This latter condition presupposes a charging apparatus in the garage of each car owner, and the efforts of manufacturers to date have been expended along the line of making a battery charging apparatus which is at the same time economical to buy and absolutely simple and automatic in its operation. The mercury rectifier appears to fulfill the first requirement, but it causes more or less trouble often at a time when it is most needed. The alternative seems to be to fall back on a motor-generator set, and this is probably the type of apparatus that is now in greatest favor with electric car owners.

One of the most recent motor-generator sets that has been placed on the market is that of the Lincoln Electric Company of Canada, 311-12 Kent Building, Toronto. The simplicity of this equipment appeals to every driver and is such that a woman can operate it quite as satisfactorily as a man. It is only necessary to insert the charging plug on one end of the wire in its receptacle in the car and close the switch in the little switch box or wall panel at the other end. After that the charging set automatically regulates the rate at which the cells are charged and it is claimed that using this particular apparatus the life of the batteries is quite twice as long as when they are charged with a mercury rectifier. When one considers that the initial cost of a storage battery is a very considerable portion of the cost of the car, it is seen at once how important is this claim. This charging outfit tapers off the current as the battery becomes charged, so that at the end of the required period the input is only from three to seven amperes, depending on the size of the battery. At this rate, any little time of overcharge does not cause the battery to deteriorate as would be the case if a higher charging current were used over too long a period. This company have issued a booklet in which they print comparative figures showing the cost of charging. With the mercury arc rectifier, the cost is placed at 5c. per mile,

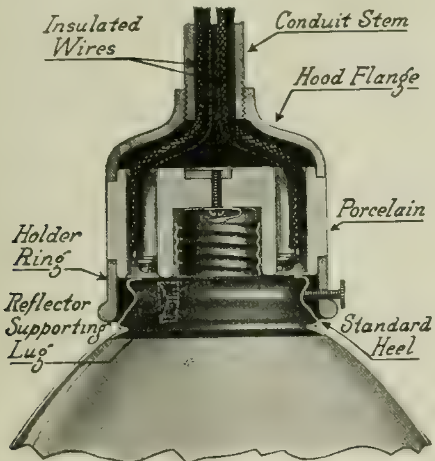


The Lincoln Charger.

while with the Lincoln outfit it is slightly less than 3c. If we take the life of the car as 50,000 miles, it is seen what a considerable item in the cost of operation the greater efficiency of this charging set will become. The equipment is illustrated herewith.

Cutter Holder Sockets for Standard Heel Reflectors

A new device which combines a holder for standard heel reflectors and a socket for Mazda lamps has recently been designed and placed on the market by the George Cutter Company, South Bend, Indiana. The holder-socket, as the new device is called, is made in three different styles—with hood flange for attachment to ½ inch conduit—with 4 inch cover for attachment to outlet boxes, and with porcelain bushing for drop-cord suspension. It is also made in two sizes—for 2¼ and 3¼ inch standard heel reflectors. One of the most important considerations entering into the design of the holder-socket is simplicity of construction. The result has been a very compact device that is not only easy to wire but possesses a number of other advantageous features. These include: 1st. The reflector is held level and secure in its correct position with respect to the lamp filament. 2nd. The reflector body is insulated from the conduit. 3rd. The method of supporting the reflector is very simple, one thumb-screw locking it firmly in place. 4th. Reflectors may be removed and replaced by a few turns of the thumb-screw. 5th. The holder-socket with outlet-box cover permits of the installation of reflectors as close as possible to the ceiling, a decided advantage in installations where the head room in a building is low.



The accompanying illustration shows the construction of the holder-socket. It consists of a cast-iron ring which has two lugs and a thumb-screw for engaging the groove in the heel of the reflector. This ring is attached, by means of two screws, to a porcelain body which includes the socket shell and wiring terminals. The porcelain body is attached to a hood flange tapped for ½ inch conduit or to a 4-inch outlet-box cover by means of two screws which are independent of the screws which support the holder ring. It can readily be seen that the holder-socket is easily and quickly installed. It is claimed one of these holders can be installed by one man in two minutes, thus effecting material savings on installation costs. For attachment to conduit stems it is only necessary to screw the hood flange to the conduit, thread the wires through the holes in the porcelain body, fasten the socket to the hood flange and connect the wires to the terminals. For attachment to outlet-boxes the installation is even more simple, only two operations being necessary to wire the holder-socket complete and ready for the lamp and reflector.

Down-Town Show-Room for Jefferson Glass Co.

For the convenience of their customers, the Jefferson Glass Company have opened a down-town show-room at 164 Bay Street, Toronto, where they will exhibit samples of their entire line of illuminating glassware and carry small stocks of staple lines for immediate deliveries. They trust that contractors and dealers will make the fullest possible use of this show-room, bringing in their customers to select glassware when they deem it advisable to do so, and making the show-room a place of call whenever they are in the neighborhood. The company state their policy to be that their products will be sold only through electrical jobbers, contractors and dealers, and in opening up this show-room it is the intention that this policy shall be strictly adhered to. Nothing will be sold retail under any circumstances. Any of the general public who may come in will be shown the line but referred to their usual dealer for making a purchase.

Jefferson Glass Co's. Show Rooms, 164 Bay St., Toronto.

Mr. Teeter will make this show-room his headquarters when he is in the city and will be glad to see any of his old friends there. Mr. E. T. Garner, for many years connected with the Toronto Electric Light Company in the capacity of new business salesman, has joined the Jefferson sales staff and will work from the down-town show-rooms as city traveller in conjunction with Mr. Teeter. The services of these gentlemen will be gladly given to any customers who may desire help in putting the Jefferson products before prospective customers.

The Electrical Committee of the National Fire Protection Association will convene on Tuesday and Wednesday, October 23 and 24, beginning at 10 a.m., in the rooms of the New York Board of Fire Underwriters, 223 William Street, New York City. Matters to be considered will be those listed in the bulletin for the adjourned March 28-29 meeting, issued under date of February 15.

Current News and Notes

Aylmer, Ont.

The material necessary for remodelling and extending the Aylmer distributing system has been ordered and a 13,-200-volt line will be constructed from St. Thomas to Aylmer. Tenders are also being secured on motor-driven pumps for domestic and fire purposes.

Blenheim, Ont.

The town council is offering the former power house and contents for sale. The building has been out of use since the advent of the Hydro.

Barton Township

The Barton Township council has decided to submit Hydro electric and enabling by-laws to the ratepayers in this township, and the work of preparing estimates to determine the amount of the money by-laws is now under way.

Brantford, Ont.

The Duke of Devonshire will officiate at the unveiling of the memorial to Alexander Graham Bell, world-renowned as the inventor of the telephone, on October 24.

Brantford Township

The Hydro-electric enabling by-law and the money by-law were submitted to the ratepayers in Brantford Township in districts immediately adjoining the city of Brantford, as canvassed by the council, and both were carried. The money by-law was for the amount of $27,000, to cover the cost of purchasing the lines and system of the Western Counties Electric Company, and extending and remodelling these lines.

Dashwood, Ont.

The work of building a distributing system in Dashwood under the supervision of the Commission's engineers is now under way.

Drayton, Ont.

The Hydro-electric enabling and money by-laws were submitted to the ratepayers and were both carried by large majorities. Arrangements are being made by the municipality to purchase the local system, which will be remodelled and extended to make it suitable for Hydro-electric power. Material is being ordered for the 4,000-volt transmission line to supply this municipality.

Dundas, Ont.

An electric lighting system was recently installed in St. James' Church.

Fergusonvale, Ont.

Estimates have been submitted to the Floss Township Council, covering service to the village of Phelpston and Hillsdale. Should the ratepayers decide to secure Hydro power, service will be given by means of an outdoor pole type sub-station located at Fergusonvale.

Midland, Ont.

The local distribution system is being remodelled to take care of the increased demands for power, due principally to the manufacture of munitions. The load in the municipality is increased approximately 400 per cent. since the beginning of the war, and a new sub-station is being constructed and provision made for two additional power feeders.

Montreal, Que.

La Compagnie Couture, Rheault, Ltd., incorporated with a capital of $99,000, is formed to acquire water and other powers for the generation of electricity in the districts of Rimouski, Gaspe, Chicoutimi, and Saguenay; to erect transmission lines, and to carry on telephone and telegraph businesses.

Parry Sound, Ont.

The municipal council of the town of Parry Sound has under advisement the complete rebuilding of its present generating station on the Seguin River. The Commission has submitted a complete report on the cost of this installation.

Scarboro, Ont.

Work has been started in the township by the Hydro-electric Power Commission of Ontario on a line to go through Birchcliffe, Scarboro Junction and Agincourt. It is hoped to complete the work this fall.

Shelburne, Ont.

Contracts have been signed and arrangements made for serving three Hydro-electric power customers in the municipality which will increase the town load by approximately 150 horse power.

Toronto, Ont.

Sir Henry Drayton, chairman of the Dominion Railway Commission, has been selected as a royal commissioner to conduct an investigation into the exportation of power generated at Niagara Falls to the United States.

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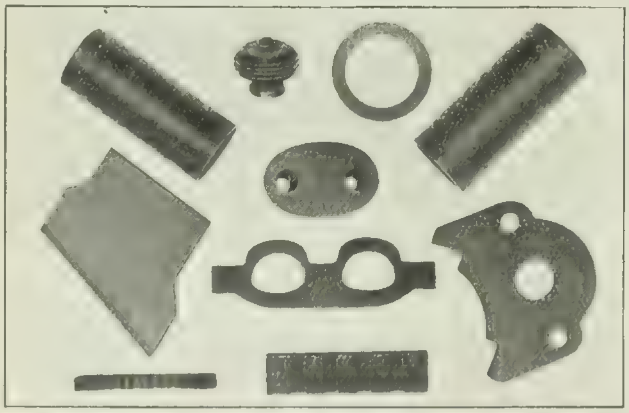

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Necessity of Conserving the Country's Supply of Technical Men

In the address recently delivered by Sir Robert Falconer, president of the University of Toronto, before the Electric Club of Toronto, figures were given of the relative number of students to be found in the various faculties to-day and before the war. In the engineering courses it was, roughly, one in six. In the other faculties perhaps a little bit better. The medical faculty was suffering with the others, and particular stress was laid by Sir Robert on the absolute necessity of maintaining this department at somewhere near its normal capacity that the requisite number of trained men may be available for carrying on the work of this profession, both during and after the war.

There is no sane Canadian citizen who does not give his unqualified assent to this appeal, especially as it was pointed out that approximately 75 per cent. of the students at present enrolled are medically unfit for active military service, and the large majority of the balance are under age as defined by the new Military Service Act. Indeed, when one considers the matter in this light, it is difficult to see why the number of students entering the various faculties is not much greater, since in all the faculties a big proportion will be under twenty years of age. One explanation, and probably the chief one, lies in the fact that the indiscriminate method of military selection that has prevailed in the past has taken a very large number of boys who would have served their country much better for two or three years at one or other of our universities. No doubt, also, the feeling that their course at the university would be interrupted has prevented many from startin at all.

That conscription will remedy this evil to a considerable extent is something for which the nation has reason to be thankful. Even if a student does not finish his course, he has made some progress towards this goal, and, this being so, he is very much more likely, after the war, to take up the thread of his life where he left off than if he had never made a start.

That Sir Robert emphasized the need of the medical profession only and omitted to place the engineering faculty in the same category was doubtless merely that he spoke of that one faculty as typical of the general need for greater conservation of our mental resources, for, invaluable as the services of the medical units have been in this war, they can scarcely be given priority to the "engineer." Indeed, is it not repeated daily that this is a war of engineers? Is it not, then, of paramount importance that the supply of our technical men should also be undiminished.

If it is necessary to segregate, for military purposes, the medical doctors, for the special work for which they have fitted themselves (and no one doubts that it is), is it not equally important that the special training of our engineers should be given the fullest consideration in alloting them their part in this titanic struggle? And, further, if it is necessary that every effort should be made to maintain, as regards numbers, the pre-war standards of our medical schools (and no one doubts that it is), is it not equally important that the attendance at engineering classes should not be allowed to dwindle? Depleted ranks in the engineering profession would be a calamity, second only to depleted ranks in the French trenches.

President Falconer is surely right when he says that pressure — government pressure, if necessary — should be brought to bear on the situation, that the ranks of the medical profession in Canada should not be depleted. The same is true in no less degree of the engineering profession. Somebody should see to it that the number of young men entering these faculties is as nearly as may be up to pre-war standards. In some way we should ensure that the technical resources of our country are sufficient to "carry on," both now and in the days of peace to come. It is a duty, as we see it, every engineer owes his country that his voice and influence be exerted unceasingly to this end.

Increasing Demand for Electric Power

The demand for power in the Province of Quebec continues to be very large, with prospects of still further calls on the various companies. This is due to industrial developments contingent on the war, the establishment at Shawinigan Falls of industries subsidiary to that of the power company, the location of others in that district because of the assurance of a reliable supply, and also to the growing recognition by large manufacturing companies of the economy of electric power.

As instances of this increase in demand, Mr. J. E. Aldred, president of the Shawinigan Water and Power Company, states that before 1917 ends 18,000 h.p. of new business will go into effect, 15,000 h.p. of this being taken at Shawinigan Falls. The increase is in addition to 6,000 h.p. connected up as new load. Measured in kilowatt hours, the output of the combined Shawinigan system showed an increase of no less than 30 per cent. in the four months of May, June, July, and August, as compared with the corresponding period a year ago. The industries controlled by the company are important factors in this increased consumption; the Carbide Company's output is 50 per cent. larger than a year ago, while the electrode plant cannot meet all the demand. The Aluminum

Company is now taking 10,000 h.p., and the Canadian Aloxite Company, which is building an extensive plant at Shawinigan Falls will take a large block of power. In another direction the Public Service Corporation, of Quebec, have increased their business 25 per cent. as compared with last year.

As a result of this situation, says Mr. Aldred, the resources of the Shawinigan system are being used up as fast as they can be developed. The Laurentide Power Company's output will be increased next year about 30 per cent. by the completion of the dam at the head of the St. Maurice River. That, however, is not the only dependence of the system for growth in the early future, as surveys have been started at the Gres Falls power site, purchased from the old Union Bag and Paper Company a couple of years ago, with a view to development at a comparatively early date. The Shawinigan Company are also building an aerial span 5,000 ft. long, supported by towers 350 high, across the St. Lawrence at Three Rivers.

"I am not going too far in saying," adds Mr. Aldred, "that we have here in this province the greatest power situation in the world. We are using up power faster than in any zone similar to Shawinigan on this continent. Our large resources are supplemented by the fact that we are offering the best service and the greatest reliability in supplying power."

Other power companies in the province are also extending their operations. The Montreal Tramways have just added a 17,000 h.p. steam unit to their plant, and have commenced work on another unit of the same size. The Southern Canada Power Company have mapped out an ambitious program, and are carrying out extensions to their plant and to their transmission lines in one of the most promising industrial districts of the province. The company are owners of very large water-powers, which, when fully developed, will mean a very important addition to the power resources of Quebec. Meantime the company are gradually enlarging their operations and acquiring new territory, the revenue returns showing substantial gains. The Cedars Rapids Manufacturing and Power Company are adding to their powerhouse and installing new units, owing to the continued requests for power. In this connection the August earnings of the Civic Investment and Industrial Company, operating the Cedars Rapids plant and the Montreal Light, Heat, and Power Company, are significant. The earnings for that month were $783,412, which compares with an average of $754,000 for the nine months, August, 1916, to April 30, 1917. At Sherbrooke, where the demand for power exceeded the supply, the city has purchased an additional water-power, and are planning to build a transmission line and to instal further equipment.

It looks as if the prophecy of Mr. Julian C. Smith, at the annual convention of the Canadian Electrical Association in Montreal, is becoming a realized fact even sooner than he anticipated. He then said: "We are in the midst of an enormous extension in electric power systems, and we may look forward to doubling the sale of electric energy in the next ten years. A good portion of the doubling will no doubt be in the large users of power, including, perhaps, the railways, but there will be a very large amount of increased power sold to individuals, due to the fact that the demand for each household using power is going to increase, and the use per capita from this cause alone will represent a very great number of kilowatt hours per annum."

Mr. P. T. Davies was presented with a gramophone and records and an address prior to leaving the position as power sales manager of the Montreal Light, Heat, and Power Company to become the manager of the new business department of the Southern Canada Power Company, Montreal. The presentation was made by Mr. J. S. Norris, manager of the Montreal Light, Heat, and Power Company. The address contained expressions of good-will and wishes for further success. Mr. Davies briefly replied.

Comparative Tests of Coal, Kerosene, and Electricity for Cooking

By B. L. Steele*

The results of comparative tests of coal, kerosene, and electricity for cooking herein presented have been accumulated in connection with a special course in physics which the writer has given for several years at the State College of Washington for the students in the department of home economics.

The efficiency tests of gas, kerosene, gasoline, and alcohol burners and of electric heating appliances have been made each year by the girls in this course, and have been carefully repeated and checked by the writer and laboratory assistants. The tests on coal ranges were made on the two Monarch ranges in the home economics department, on the ranges in the homes of students living in Pullman, and at sorority houses. The cooking cost data were obtained at the Home Economics Practice Cottage.

Table I. gives the value in calories, or the heat equivalent, of 5 cents' worth of each of the various "fuels" at the prices prevailing in Pullman, Wash., in December, 1916:

Table I.

Fuel	Calories
Coal (Rock Springs) at $10 per ton	32,250,000
Kerosene at 20 cents per gallon	8,550,000
Gasolene at 25 cents per gallon	6,130,000
Alcohol at 75 cents per gallon	1,340,000
Electricity at 3.85 cents per kw. hr.	1,116,000

Table No. II. gives the average efficiencies of the various kinds of cooking equipment. In determining the maximum efficiency of the coal range the entire top was covered with large vessels of water—e.g., wash boilers or five gallon gasolene cans, the oven being similarly used. The fire was not lighted until the initial water temperature had been taken; and usually two pounds of kindling and ten pounds of coal were completely burned before the record of the final maximum temperature was made. It was estimated that, as the coal range is used for cooking in the average home, not more than one-fourth of the available space is utilized at any one time, and that the cooking operations are being carried on less than one-half of the time during which the coal is burning. If this estimate is correct, the average "cooking" efficiency of the coal range does not exceed 2 per cent.

Table II.

Kind of cooking equipment	Efficiency. Per cent.
Coal range (entire space utilized)	18
Coal range, estimated home cooking (about)	2
Flame contact burners (kerosene, etc.)	28
Electric heaters, surface	45 to 65
Electric heaters, enclosed	70
Electric heaters, immersion	90

The efficiencies of the flame contact appliances, which included standard kerosene and gasolene blue flame burners, alcohol lamp for chafing dishes, and gas burners, varied from approximately 20 per cent. to 35 per cent. The calorific values of the various fuels were obtained either from dealers or standard hand-books, or were determined in the laboratory.

Nearly every kind of electric heating appliance was used and under widely varying conditions. Room temperatures, existence of air currents from open windows, material and condition of surface of utensil used, wattage of heater, relative size of heater and utensil, and quantity of water heated were all found to affect the efficiencies very considerably, particularly those of the surface and immersion types. In these experiments the thermometers, standard ammeters, and voltmeters, and the balances used were such, and the care exercised was such, that a variation in efficiency greater than 1 per cent. was not to be attributed to accidental error.

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* Professor of Physics, State College of Washington.

Table No. III. gives the data and results of several efficiency tests of electric heaters:

Table No. III.

Items.	Surface heaters A.	Surface heaters B.	Encl's'd heater	Immers'n heater
Mass of water heated (grams.)	4536	4536	2268	1360
Room temperature (centrigrade, deg. C.).	21	22	21	22
Initial water temperature (deg. C.)	18.2	22.6	16.4	19.5
Final water temperature (deg. C.).	93.2	96.5	65	92.0
Temperature increase (deg. C.)	75.0	73.9	48.6	72.5
Heat absorbed (calories)	340200	335200	110225	98600
Heater turned on	3.00	12.13	7.37	9.30
Heater turned off	3.32	12.58.30	8.33	9.46.49
Time in use (seconds)	1920	2730	3360	1009
Current (amperes)	10.32	8.69	1.63	4.00
Potential difference (volts)	115	115	110.0	110.0
Elec. energy expended in heater (joules).	2278656	2730000	602148	443960
*Heat equiv. of elec. energy (calories)	544221	652000	143880	106033
Efficiency, per cent	62.5	51.4	76.6	93

*4.187 joules are equivalent to 1 calorie.

The average working efficiency of the electric range, as used in the home, depends on so many factors that to make an accurate estimate is rather difficult. It is believed, however, that in the hands of those who have had a bit of experience in making the proper combinations of surface, enclosed, and immersion heaters the efficiency should be above 60 per cent.

Table IV. gives the heat available for cooking in 5 cents' worth of each of the "fuels," proper allowance having been made for the working efficiencies of the various cooking appliances:

Table No. IV.

"Fuel."	Calories
Coal (range at 2 per cent. efficiency)	623000
Kerosene (range at 28 per cent. efficiency)	2400000
Gasolene (range at 28 per cent. efficiency)	1716000
Eletricity (range at 60 per cent. efficiency)	626600
Alcohol, at 28 per cent. efficiency	375200

For the purpose of affording laboratory work in the course in household administration the department of home economics at the State College of Washington maintains a practice cottage. The seniors each year are divided into groups of four students each, and each group, together with a chaperon, spends four weeks in the cottage. This arrangement permits each student to have the management of the cottage for one week. Before entering upon the month's work at the practice cottage each of the four girls has made out a week's menus, and has determined the necessary quantity of each article of food entering into each menu according to the needs of the members of the group. The girls are "weighed in" at the beginning and "weighed out" at the end of the month, and in most cases are found to have fared better than on their regular boarding house or home cooking.

During this year, through the generosity of the Washington Water Power Company, the practice cottage has been equipped with a Westinghouse electric range, in addition to the coal range. This arrangement has made it possible to obtain data on the cost of cooking with coal and electricity for a family of five. During the winter, when the furnace was in use, the water-front of the coal range was disconnected, the hot water for domestic use being furnished entirely by the coil in the furnace. During the late spring the water-front was connected up and all hot water needed was heated by the range in connection with the cooking.

In considering the results which follow, the fact that the work was carried on by students who were busy with other regular college work must not be lost sight of, and it should be mentioned also that each of the 19 girls who lived in the practice cottage had had considerable experience cooking on the coal range, and that none of them had had experience with the electric range. To help us out of this difficulty the Washington Water-Power Company very generously offered the services of their expert, Miss Addison, who gave demonstrations to the groups on several occasions. Each student, whether cooking on the coal range with or without the water-front or on the electric range, was instructed to practice economy as much as possible.

Table No. V. gives the cost, by meals, of one week's cooking on the electric range, and Table No. VI. gives the week's menus. Two meters were provided—one for the oven and boiler and one for the plates. The meters were read before and after each meal, and in every case tenths of kilowatt hours were carefully estimated.

During the month of December, 1916, the average value of a kilowatt hour in Pullman was 3.85 cents. This value was used in calculating all the electric cooking costs.

Table No. V.—Electric Range

Day.	Kilowatt-hours. Breakfast. Oven.	Plate.	Lunch. Oven.	Plate.	Dinner. Oven.	Plate
Monday	.5	1	.7	2	1.0	0.0
Tuesday	7	.5	.5	0.0	6	4
Wednesday	.5	1	.5	0.0	2.4	7
Thursday	.6	0.0	1.0	0.0	1.4	0.0
Friday	.6	.2	.6	0.0	3	8
Saturday	0.0	1.0	.5	2	2.0	6
Sunday	0.0	3	1.1	.4	0.0	0.0
Total kw. hours	5.1		5.7		10.2	
Total cost (c.)	19.6		21.9		39.3	
Cost per meal	2.8		3.13		5.65	
Total cost for week					80.8 cents	
Average cost per meal					3.85 cents	

Table No. VI.—Week's Menus—Electric Range

Day	Breakfast.	Lunch.	Dinner.
Monday	Cream of wheat, corn muffins, syrup, coffee.	Cream potato, bread and butter, apple sauce.	Pork, roast potatoes, tomatoes, apple sauce, bread and butter.
Tuesday	Baked apple, muffins, coffee.	Rice and cream, bread and butter, salad.	Spaghetti and cheese, fried potato, buttered carrots, cottage pudding, bread and butter.
Wednesd'y	Graham mush, rolls, coffee.	Cheese sandwich, apple sauce, cake, chocolate.	Veal loaf, baked potato, creamed onions, gravey rolls, jelly cake, coffee.
Thursday	Marmalade, rolls, coffee.	Escalloped potato, tea, baked appre, bread and butter.	Cream salmon on toast, mashed potato, bread and butter, apple pie.
Friday	Muffins, cereal, syrup, coffee.	Salad, pudding, bread and butter.	Pork chops, potatoes, tomatoes, bread and butter, custard.
Saturday	Hot cakes, syrup, cereal, coffee.	Potato, apples, onion salad, rice and cream, bread and butter.	Roast pork, baked potatoes, creamed onion gravey, bread and butter, cream cake, coffee.
Sunday	Fried mush, toast.	Bread and butter, fruit cake.	Veal roast, gravey, baked potato, creamed onion, bread and butter, cream cake, coffee.

Table No. VII. gives the cost by meals of one week's cooking on the coal range, the water-front being disconnected:

Table No. VII.—Coal Range, Water-Front Disconnected

Day.	Pounds. Breakfast. Wood.	Coal.	Lunch. Wood.	Coal	Dinner. Wood.	Coal
Monday	3.00	8.00	2.00	6.00	3.50	6.00
Tuesday	3.00	5.00	2.25	6.00	3.00	6.50
Wednesday	4.00	4.00	3.00	4.50	3.25	6.25
Thursday	3.00	6.50	4.00	7.00	5.00	9.00
Friday	3.00	2.75	2.00	2.75	2.50	6.00
Saturday	2.00	1.75	6.00	2.00	5.75	5.00
Sunday	3.75	5.25	1.50	5.00	1.50	8.00
Total pounds	21.75	33.25	20.75	33.25	24.50	46.75
*Cost (cents)	6.5	16.6	6.2	16.6	7.35	23.4
Total	23.1		22.8		30.8	
Cost per meal	3.3		3.25		4.4	
Total cost for week					76.7 cents	
Average cost per meal					3.65 cents	

*Value of 1 pound of wood, 3 cents; pound of coal, 5 cents.

Table VIII. gives the cost by meals of a week's cooking on the coal range, with the water-front connected:

Table VIII.—Coal Range, Water-Front Connected

Day.	Pounds. Breakfast. Wood.	Coal.	Lunch. Wood.	Coal.	Dinner. Wood.	Coal.
Monday	5.50	4.50	6.50	9.50	3.75	9.75
Tuesday	3.75	6.50	9.25	7.00	6.00	7.50
Wednesday	6.00	9.00	5.50	4.25	5.50	3.25
Thursday	4.00	2.00	9.00	9.75	9.00	9.75
Friday	4.50	9.75	4.50	5.00	5.50	13.50
Saturday	6.75	5.50	6.00	11.50	3.75	11.25
Sunday	9.25	15.25	5.00	0.00	3.00	18.00
Total pounds	39.75	52.50	45.75	47.00	36.50	73.00
Cost, in cents	11.9	26.25	13.7	23.5	10.95	36.5
Total, cents	38.15		37.2		47.45	
Cost per meal	5.45		5.3		6.78	
Total cost for week					$1.23	
Average cost per meal					5.85 cents	

In all, three weeks of cooking were done on the coal range with the water-front disconnected, four weeks with the water-front connected, and five weeks with the electric range.

Table No. IX. gives the average costs per week and per meal of this work:

Table No. IX.

Equipment	Average cost Per week	Average cost Per meal
Coal range, water-front connected, cents	119.6	5.70
Coal range, water-front disconnected, cents	77.4	3.67
Electric range, cents	78.5	3.72

The results speak for themselves in general, but it might be pointed out, from Table VIII., that with the coal range it costs very nearly the same to cook breakfast or lunch as to cook dinner, while from Table No. V. it is seen that the cost for breakfast—the lightest meal—is about half the cost of dinner. Also from Table No. IX. it is seen that it costs 42.2 cents per week to heat the water for domestic use with the water-front on the coal range.

The writer realizes fully that the amount of data presented is far too small to justify the making of very sweeping inferences, but at the close of the coming year he hopes to have very complete results, and at present feels that he is warranted in urging that our coal supply be conserved by not using it, and that our water-powers be conserved by using them, for every pound of unburned coal is saved, but every kilowatt-hour of water-power unused is wasted.

Modern Ideals of Factory Lighting—II.

By C. E. Clewell

In addition to the advantages of good light in its relation to factory production as pointed out in the first article of this series, it is most important to consider the illumination of the factory from the standpoint of improved environment. The managements of modern plants have begun to realize that suitable environment plays quite an important part in the welfare of the employees, which in turn reacts helpfully on the conduct of the shop operations. This is evidenced by the greater care which is now being given to the appearance of factory yards and approaches as far as the exterior of the plant is concerned, and also by the greatly improved appearance of the interior of modern plants in contrast to the older and less pleasing structures which were used for manufacturing purposes.

There is no doubt of the fact that a plant which is supplied with an abundance of natural and artificial light which gives it at all times, both by day and by night, a cheerful atmosphere, possesses an asset of no small value to the conduct of the work. This feature is one which is more or less distinct from that of the economical relations of good light as discussed in the first article, but when they are taken together, they form an even greater argument in favor of the adoption of an up-to-date lighting system than if the purely economical aspects are considered alone.

Order and Neatness Promoted

Turning now to some of the phases of the question which may be classed as indirect advantages, it has been found in factory sections where the previous conditions were dark and gloomy that the addition of the new lighting system has had a tendency to make the employees more careful of their machines and to cause the foremen to take a greater interest in the maintenance of an orderly and neat arrangement of materials and in the general care of the floor space. Under gloomy conditions, there is difficulty in seeing whether dark corners are filled with accumulated dirt, and even if care is given to having them cleaned occasionally, the element of carelessness is likely to increase if such accumulations are allowed to go unattended to with the result that the general foreman or the superintendent in walking through the shop by being unable to detect such carelessness allows it to go without mention.

In sections of this kind, after the installation of a new system of general illumination, the foreman has the assurance that every effort which is made to keep the space under his supervision neat and orderly will be observed by his superiors, and the beneficial effect of such an incentive to neatness will appeal at once to anyone who has experienced the problems connected with the management of factory buildings. There are, of course, other advantages which follow greater attention to order and neatness aside from that of appearance pure and simple, and one of the most important of these is the fact that any factory section in which materials are stored systematically and the aisles are kept free from pieces of iron out of their proper places, will be safer in the everyday use of the aisles by the workmen. Good light has proved over and over again to contribute to the safety of factory aisles and workspaces through this means.

Supervision Rendered Easier

Foremen and superintendents find that in the poorly lighted shops, there is an increased difficulty in keeping track of the way in which work is being performed, and there is a natural tendency on the part of the workmen to take advantage, in some cases at least, of the conditions of partial darkness with the result that under such circumstances there is likely to be a distinct lag in the start of the work, particularly on winter mornings, when the natural light is poor, and in the late afternoons of winter days, for the same reasons. An adequate system of artificial light tends to maintain uniform conditions of work throughout the entire working day, and this, of course, adds to the possibilities of output and at the same time gives the foreman the distinct advantage of being able to detect without difficulty any cases where unprincipled employees tend to neglect their work or where carelessness in given operations takes place.

Some Modern Lighting Methods

The foregoing direct and indirect advantages of good light in its relation to production and to the general supervision of the plant will be better understood when taken in conjunction with the physical characteristics which the modern system should possess to bring about these advantages, and for this reason it is well to consider briefly at this point the principal system of factory lighting now in use.

In its general classification, factory lighting may be divided into the two cases of general illumination and local lighting. In the former, the lamps are mounted overhead and for the best results they should be distributed symmetrically over the ceiling areas so that the illumination conditions may be uniform throughout the working area. In the latter, special instances sometimes make it an advantage to mount the lamps with respect to individual machines or over and close to special work. Here the individual lamp illuminates a more or less localized space immediately under the lamp, with the result that if there is no overhead or general lighting, the space outside of this lighted zone under the local lamp will be in comparative darkness.

In addition to these two general classes, there are also modifications which lie between these two general methods. For example, it is sometimes found advisable to arrange the lamp more or less with regard to special locations of machinery, but at the same time to mount them overhead so that the system is a combination of a general scheme and a localized scheme performing the function of illuminating a special piece of machinery but also affording considerable illumination for adjacent parts of the floor area.

The general or overhead arrangements of lamps are usually much to be preferred over any special localized plan of lamps, for with the former scheme, particularly where the lamps are spaced symmetrically over the entire ceiling area, the floor space may be uniformly lighted, making every part of the working space equally adapted to the conduct of workmanship and rendering the section free from dark zones which are so likely to contribute to the accident hazard.

Care in Planning out New Systems

In view of the foregoing statements it might be inferred that the general plan of illumination should be followed at all times. While this is a good general rule to follow, it must be remembered that many cases will surely arise in every factory where special arrangements for lighting become essential to the peculiar features which surround the method of handling material or in the unusual character of the work in hand. For this reason, it is suggested that each factory section for which a new lighting system is contemplated should be made the object of careful study in advance, so as to ascertain whether a single given method of arranging the lamps will be satisfactory for all of the work included in the section. If this happens to be the case, then it is, of course, advisable to design the lighting system according to a standard symmetrical method of lamps, but if not, then it will be essential to plan out the standard scheme for those parts to which it can be applied with satisfaction and to make the necessary special arrangements for the remaining cases. In other words, general rules, while they appeal to the factory manager in the abstract, should not be followed blindly, but every given class of work in the factory should receive due care on a basis of its own individual requirements.

Actual Cases Illustrated

The principal illuminants used in modern factory lighting systems are the tungsten lamp and the mercury vapor lamp, with the occasional use of arc lamps in various instances. Fig. 7 illustrates the exceptionally good results which may be secured through the use of the mercury vapor lamp under industrial conditions. In this photograph a number of planers are shown, and the unusual detail with which the various parts of the machines are shown in the view is evidence of the clearness of the detail with which objects may be seen under this light. One feature which has been found to occur with the use of this type of lamps is the fact that they may be used to very good advantage even in those cases where the lamps must be mounted amongst line shafting and belts. This is naturally one of the worst conditions which must be faced in planning a lighting system, on account of the shadows which such belts are likely to cast on important parts of the work, and moreover, on account of the dirt which soon accumulates on the lamps, due to the flying particles of dirt from rapidly moving belts and line shafts. Due to the length of the tubes used in these lamps, the shadows cast by belts are found to be very slight in most cases, and this feature makes the mercury vapor lamp of particular value when the lamps must be mounted under such adverse conditions.

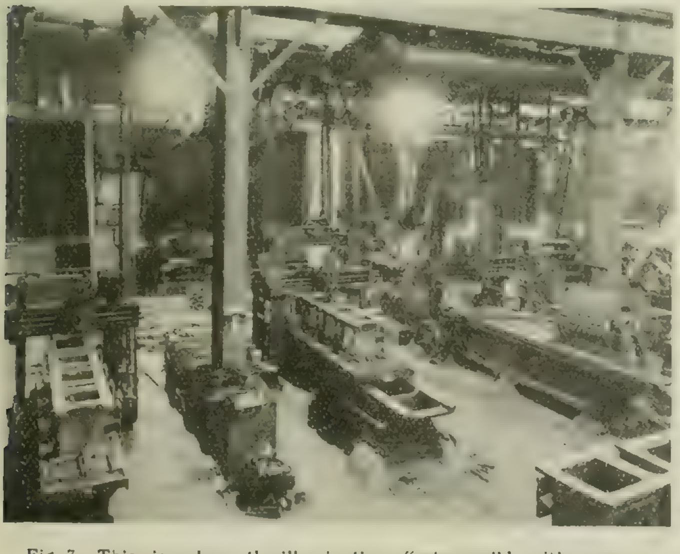


Fig. 7.—This view shows the illumination effects possible with mercury vapor lamps where planers are in use in a factory space.

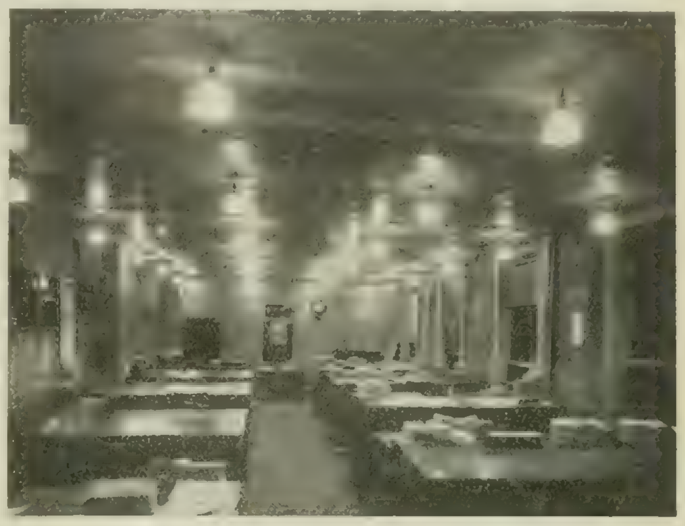


Fig. 8.—Direct lighting system in typical office—Tungstens employed with Holophane Reflectors—No drop lamps.

Use of Reflectors

The introduction of tungsten lamps within recent years in a large variety of sizes has contributed greatly to the possibilities of good lighting results under factory conditions. The character of the distribution of light about tungsten lamps, however, is such that unless some form of reflector is used, much of the light will be ineffective in illuminating working spaces below the lamps. It is most important, therefore, in the use of tungsten lamps to utilize one of the forms of reflectors which are now available for producing an efficient illumination result on the work and also for the purpose of protecting the eyes of employees from the bright filaments of these lamps.

To illustrate a practical example of a modern tungsten system, Fig. 3 is included, this being a night view taken in one of the offices connected with a large factory. Note in this view that the lamps are spaced symmetrically over the entire ceiling area and that each lamp is equipped with a reflector for re-directing as much of the light as possible towards the desk surfaces beneath. It will be further noted in this illustration that all drop cords and individual lamps have been eliminated, due to the excellence of the illumination from the overhead lamps and the space between the desks and the lamps is very much more free and open than in a similar office where this space is filled with drop cords to which individual lamps are attached near the desk surfaces.

Another way in which to utilize the tungsten lamp for factory lighting is to conceal the lamps completely, either with an opalescent under globe or with an opaque bowl, in which cases, part of the light is sent to the ceiling and then reflected to the floor. Fig. 9 shows a typical office where the indirect system is in service. Although this view relets to an office space, the use of semi indirect and indirect fixtures is beginning to spread in various industries where the quality of the diffused light furnished by such systems is found to contribute to the facilities of the workmanship.

Systematic Maintenance

The many advantages afforded by the modern lighting system depend not only on the initial performance of the system immediately after its installation, but also on the way in which it is maintained in its original condition of efficiency. It is not generally appreciated that the depreciation of lighting equipment from accumulations of dust and dirt is usually very great under average industrial surroundings. Tests on this feature show unmistakably that any lighting system, no matter how well installed, soon deteriorates due to this cause, and it follows that if the lamps and their reflectors are not cleaned at fairly frequent intervals, the system as a whole will soon fail to perform the functions for which it was originally designed and installed.

Systematic maintenance involves not only the regular cleaning of the equipment, but seeing to it that all burned out lamps are renewed promptly, and that fuses and defective switches are regularly repaired. These features have come into considerable prominence with the adoption of large numbers of small or medium sized tungsten lamps for given areas in contrast with the older plan of using only a few arc lamps to illuminate such a section. It follows that where the density of the lamps for given areas is great, it has become easier to overlook a burned out lamp here and there than was the case where the light for a very large area was furnished by a single unit. Hence it has been found in certain cases that an inspection of the entire lighting system each day by some member of the electrical department is a satisfactory means for detecting these burned-out or otherwise defective lamps, and this same inspector can readily observe the accumulations of dust and dirt on the equipment and make recommendations as to necessary cleaning. On the other hand, if such a regular inspection is not made, it may be found advisable to adopt a rigid schedule for cleaning at intervals of, say, once a month.

Light Colored Ceilings and Walls

Another item closely associated with the efficiency of the lighting system is that of the surroundings. Dark ceilings and walls absorb a great deal of the light which is incident upon their surfaces, and a system which may be entirely adequate under normal circumstances may be depressing and unsatisfactory if the surroundings themselves are dark. Hence to maintain the ceiling and wall surfaces in a light color by occasional coats of paint or white-wash may be looked upon as an asset to the lighting installation very much on the same order as the use of efficient reflectors.

Installing a Lighting System Gradually

Some cases may arise, particularly in older factories, where the desire to possess a modern lighting system is blocked by the initial expense which is too high for the funds available for the purpose. One scheme which has been found to work out successfully in such cases is to adopt a plan for the installation of a complete system throughout the entire factory, but to undertake the work gradually and to extend it through a period of months or even a year or two. In this way the initial expense is distributed, and does not fall so heavily on the funds of the plant.

It is suggested, however, in the adoption of such a plan that a study of the needs of the entire plant be made insofar as possible in advance of any of the work, so that a uniform policy in the matter of class of lighting equipment may be decided upon for the entire job. Furthermore, it is highly desirable in such cases to plan out the location of lamps and outlets for an entire section of the factory, even if a portion only of the section is to be equipped at the time. To have such complete plans on hand during the progress of the work of wiring and installation insures that the system when completed will form a well designed unit, thus contributing to the symmetry of the factory and giving to every employee an adequate supply of light.

The Importance of Side-Light in Certain Cases

Considerable emphasis has been placed on the importance of uniform illumination in the above notes. To speak of uniform intensity on the work usually implies that the downward component of the illumination shall have the same value for all parts of the floor space. However, many cases arise in practice where the downward component of the light is not the all important part of the requirements, because of the fact that such work may be viewed from the side rather than from above. Take the work in a vise, for example. The employees may be called upon to perform all of the operations on the side of such a piece of work, and even though the vertically downward light may be entirely adequate, if the side component is low, the effect for this particular operator may be far from satisfactory.

To overcome such a difficulty, it may be necessary to adopt a type of reflector for overhead lamps which distributes the light over wider angles than the type which would give uniform downward illumination, in which case by the use of a slightly larger lamp the downward intensity may be maintained at its required value, and at the same time the side component may be sufficiently increased to take care of the special requirements of some of the work. Of course, it is also possible in such special cases to install an individual lamp on a bracket which is so arranged that the employee may adjust it to suit any particular needs. In general, however, it is best to design the overhead general system of lighting so as to take care of all the requirements for the purpose of eliminating as far as possible all drop or individual lamps.

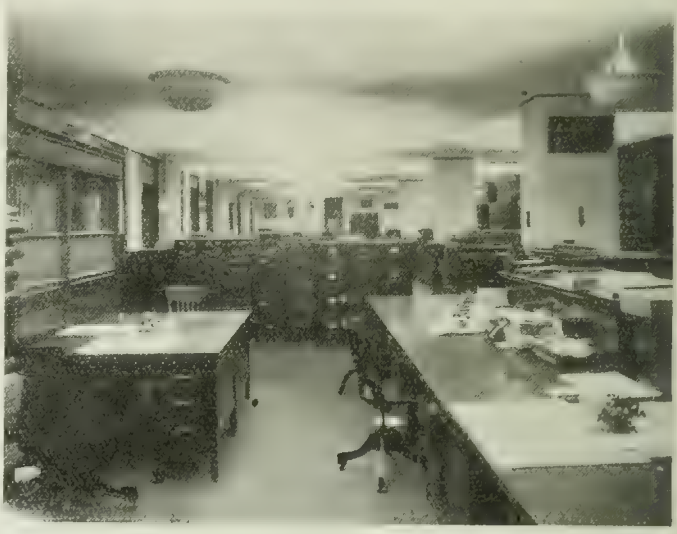


Fig. 9.—Night view of office with indirect system Note uniformity of lighting on desk surface.

These notes endeavor to set forth the broad general points which are involved in the modern factory lighting system. It is not possible in a brief space to touch on many of the more specific phases of the problem involved in the design of the system, but before the adoption of a modern system in the older factories can be an established fact it is necessary for the owners or the management to gain the proper perspective concerning the many advantages of good light to the plant, and it has been for the purpose of directing special attention to these advantages that the two articles of this series have been prepared.

Electric Railways

New Rolling Stock in Form of Three Handsome Trailers Just Delivered by Ottawa Car Mfg. Company to the M. & S. C. Company

The Montreal & Southern Counties Railway have received recently from the Ottawa Car Manufacturing Company three trailer cars for interurban service, the main features of which are as follows:—

	Feet	Inches
Length over vestibules	53	8
Length of car over buffers		53
Length over corner posts	43	4
Distance between bolsters	30	8
Width over all at eaves	8	6
Width over side sills	8	¼
Height, top of rail to top of roof	12	8½
Normal seating capacity	60 persons	

The car's sides are straight and sheeted with poplar sheeting. The roof is of monitor type, with ventilating deck sash, operated by M. & S. C. R. standard deck sash fixtures, and glazed with opalescent glass. The side sash are of mahogany; top sash glazed with opalescent glass set in lead, cathedral design. All body side windows are equipped with wire screens. The interior is furnished in Mexican mahogany, dull finish. All metal parts are Ottawa Car Mfg. Company's standard car bronze, highly polished and lacquered. The seats are of the railway company's standard reversible type, upholstered in green imitation leather. The cars are built on a steel underframe of specially light and strong construction and are of through platform type. They are equipped with heaters, automatic couplers, Westinghouse electro-pneumatic signal equipment, also control train line for h.l. control. The basket racks are of M. & S. C. R. standard design.

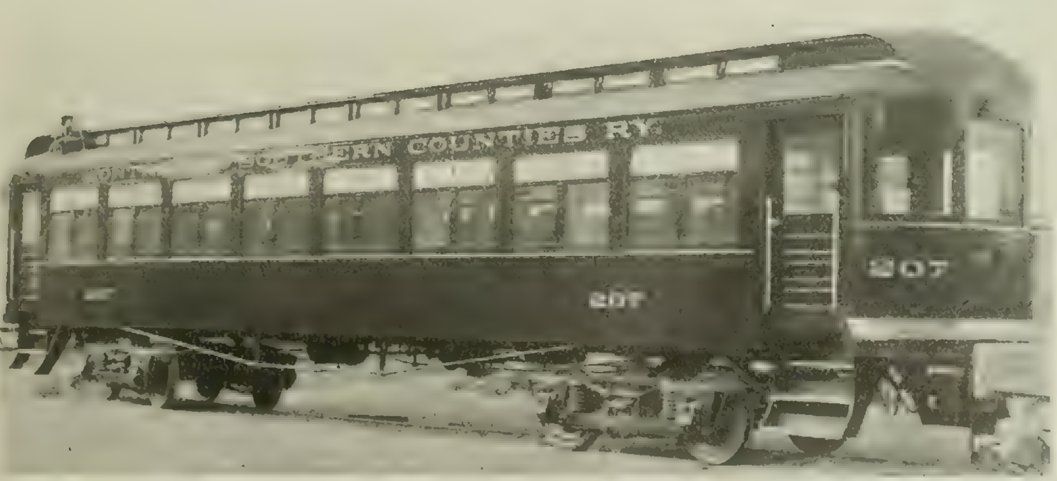
The lighting consists of clusters on the ceiling, also individual lights along the lower deck rail moulding. The cars are mounted on trucks with 33 in. cast iron wheels. A special feature of the underframe is a specially constructed anticlimbing spring buffer, built to take all ordinary buffing shocks and minor collisions. The car is equipped with marker brackets, also steel trap doors at the side openings. These trap doors are hinged to the vestibule doors with heavy bronze hinges, bolted on in such a way that when the door is open the trap is folded up behind the door. The car is also equipped with a lavatory on one side, with a standard improved dry hopper closet, also a 5-gallon water cooler. The curtains have spring plug rollers. The sash locks are of single cam type, with a heavy rack on the stop. The sash are also equipped with anti-rattler and improved drop handle hand brakes.

The Operation of Auto Buses Does Not Pay—Tire Expense too Heavy—Other Useful Data

Some interesting figures have been compiled by the Fort Wayne and Northern Indiana Traction Company on the operation of four autobuses which have been running during the past summer as a temporary service, covering an area where a car line is not financially feasible. The Electric Railway Journal describes the situation.

The territory to be served lay between two existing electric railway lines, separated by something over one mile, and the route established for the autobus fleet ran between these two lines, the length of route being approximately two miles. The entire trip is over paved streets, and the only difficulties in operation are two railway crossing and two 3 per cent. grades about 400 feet in length.

The bus line was placed in operation on March 16, 1917.



Typical of three new trailers just received by M. & S. C. Company from Ottawa Car Mfg. Company.

with a ten-minute schedule, maintained for eighteen hours of the day. It requires only two buses to give this schedule, but due to numerous pull-outs for repairs, two additional buses are needed to maintain service. Stops are made at every street corner, as with our regular car service. The experience thus far would indicate that the frequency of stopping and starting the buses will be a very important factor in determining the life which can be obtained from this equipment. It is our opinion that stops should be made only at every other block.

Table I.—Showing Gross Revenue and Bus Mileage of Line

Period.	Gross revenue	Bus mileage
March 16-31	$156	4,522
April	489	11,175
May	576	11,776
June	623	11,368
July	681	10,639
Total	$2,525	49,780

Average gross revenue per bus mile .... 5.072 cents

The tire expense for the solid tires on the rear wheels is very high, as shown in the accompanying table of expenses. The revenue assigned to the bus line has been the entire cash and tickets actually collected on the buses. The regular six-for-a-quarter electric railway ticket is good on this line, and transfers are issued to connecting railway lines and honored from the latter lines. The transferring appears to be about equal in both directions.

While the revenue has increased each month, it is very doubtful that the line can be made to pay individually for its full operation. A study of the revenues for the two lines with which the buses connect, for the past three years, indicates that the additional business created by virtue of the bus line acting as a feeder is not particularly large. The revenue for the electric lines serving this territory is higher per car-mile than the total revenue per car-mile for all our lines, including the autobus line, since the beginning of the bus operation.

The one-man operation on the buses is proving very satisfactory. Motormen from the city lines have been employed as chauffeurs at an advance of 2 cents per hour over the regular city rate. The location of the bus line has been changed once since the beginning of operation, as a means of determining the effect of different locations upon the volume of traffic. Some minor changes in the bus operation would probably be made if a permanent line were to be established in this territory. The experiment has been profitable as a means of determining the proper location for a new line. It has also developed the fact that as an independent line, even in a reasonably thickly-settled residential district, it could not be made to pay unless it were possible to reduce repair bills and increase the rates.

Table II. is a statement of the operating expenses for the period mentioned:

Table II.—Showing Operating Expenses and Cost Per Bus Mile of Line

	March.	April.	May.	June.	July.	Total.	Cents per bus Mile.
Repair labor	31.85	38.51	62.84	115.49	66.61	315.30	0.623
Repair [illegible]	0	0	11.30	147.51	0	158.81	0.319
Misc. material	2.80	1.09	12.36	8.10	8.41	32.76	0.066
Front tires	0	87.68	81.23	0	0	168.91	0.339
Rear tires	0	0	0	239.40	314.98	554.38	1.114
Tire repairs	0	1.75	9.00	0	47.50	58.25	0.117
Lamps	0.25	1.50	3.01	3.58	0	8.34	0.017
Battery repairs	0	0	0	2.61	11.20	13.81	0.028
New battery	0	27.70	0	0	0	27.70	0.056
Gasoline and oils	99.17	340.57	274.42	270.85	244.01	1229.02	2.469
Registration fee	20.00	0	0	0	0	20.00	0.040
Chauffeurs' license	14.00	0	0	0	0	14.00	0.028
[illegible]	40.00	0	0	0	0	40.00	0.080
[illegible]	0	80.00	0	0	0	80.00	0.161
Depreciation at 5 per cent. a month	146.53	293.06	293.06	293.06	293.06	1318.77	2.649
Operators' wages	149.29	337.25	361.57	337.57	350.10	1535.78	3.085
Total	503.89	1209.11	1108.79	1418.17	1335.87	5575.83	11.201

Dixon Motors, Limited, has been incorporated "to carry on the business of electricians, mechanical engineers, and [illegible] Head office [illegible] capital, $10,000.

Program for the 1917 Conference A.E.R.A.

Secretary Burritt of the American Electric Railway Association has announced that the conference of the American Electric Railway Association, which will take the place of the convention usually held during the second week in October, will occupy one day only, and will take place in New York on Oct. 9. It will be held in the United Engineering Societies Building, at 29 West Thirty-ninth Street. The subjects to be discussed are as follows:

General survey of electric railway problems.

Is the "war bonus" practicable as a means of wage adjustment in the electric railway industry?

Female substitution for trainmen.

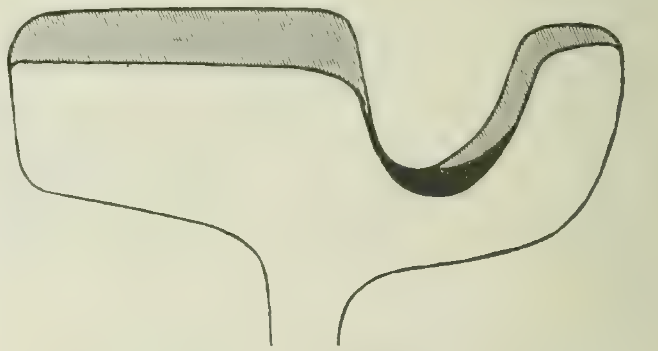
Pending application for fare increases in New York State.

Topical discussion of various methods of increased fares: (a) Charge for transfers; (b) increases in flat rates for present zones; (c) shortening present single-fare zone.

The names of those who will present papers on these subjects have not yet been announced, as acceptances have not been received from all. It is expected that the first paper —that giving a general survey of present electric railway problems—will be presented by President L. S. Storrs. The other papers will then outline the principal methods which have been suggested for meeting these problems.

The Renewal of Rails by Deepening the Groove —Successful Experiments in England

An interesting article appears in the Tramway and Railway World of date August 16, describing a new and apparently economical method of rail renewal. The drawing herewith explains the method adopted, i.e., deepening the groove. The original section of the rail head is shown by the top line, the wear that took place in each case is indicated by the shaded portion, while the part of the groove which has been cut out by the machine is shown in solid black.



Shading indicates worn, and black indicates ground portion.

This is one of a number of sections reproduced in the article referred to, and it is stated that these illustrations show that rails which have become so badly worn as to be useless can be given an additional life of from five to eight years. The standard depth of flange on tramway systems is 18/32 inch and the original depth of groove is from 1 inch to 1⅛ inch. Where the head of the rail in which the groove is 1 inch becomes worn away to the extent of 14/32 inch, the flange of the wheel must ride on the groove, and from this time on depreciation of the rail is exceedingly rapid, while the lip of the rail is liable to fracture and break away. The thickness of the material below the groove of some of the rails is 24-32 inch, and with the special remodelling machine it is possible to mill out about one-half of this depth, leaving the thickness of the metal at the bottom of the groove about 12-32 inch, which is considered sufficient to carry the weight of any ordinary traffic, the guard of the rail being protected by the pavement.

This method is advanced as being of special value at the present time, owing to the great demand for the necessary materials for replacing the rails. If the life of the tracks can be extended from five to ten years it will set ahead the necessity for large capital expenditures, as well as considerable drain on supplies for that length of time, which, in all reasonable probability, will have seen the markets and supply returned to more or less normal condition. The article in question makes an estimate of the requirements of the tramway systems in England up to 1921, which it places at 317,874 tons. If this demand can be delayed, the new method, even if it proves costly, will have justified itself.

Mr. Kirkwood's Promotion

Mr. Malcolm W. Kirkwood, the recently appointed general manager of the Galt, Preston and Hespeler and the Lake Erie and Northern electric railway systems, got his first electrical experience during the installation of the arc lighting system at Georgetown, Ont., many years ago. The power plant which supplied this system was located at Glen Williams and Mr. Kirkwood was later connected with the operation of this plant; this was about the year 1890. In 1894 he moved to Galt and was employed in the construction of the Galt & Preston street railway power station at Preston. When the road started operations in the fall of the same year he was retained in the maintenance department, and in the next year assisted in the building of the line from Preston to Hespeler. Later he was placed in charge of equipment, track and line, and supervised the building and equipping of the line to Kitchener and Waterloo in 1902. In 1907 he was appointed superintendent of the line, which position he retained up to the present promotion. Along with his other work, Mr. Kirkwood had charge of electrifying and equipping the Lake Erie & Northern in 1915, and was made superintendent of this line also when operations commenced in February, 1916.

Mr. Malcolm W. Kirkwood.

The elimination of electrical display advertisements and all other non-essential illumination in New York and other eastern cities of the United States next winter will be recommended by the coal administration, according to the opinion of officials in touch with the fuel situation. It is reported that the president looks with favor upon the proposal if it can be effected by voluntary arrangements with electric companies and advertising agencies.

"As the Twig is Bent, the Tree's Inclined"

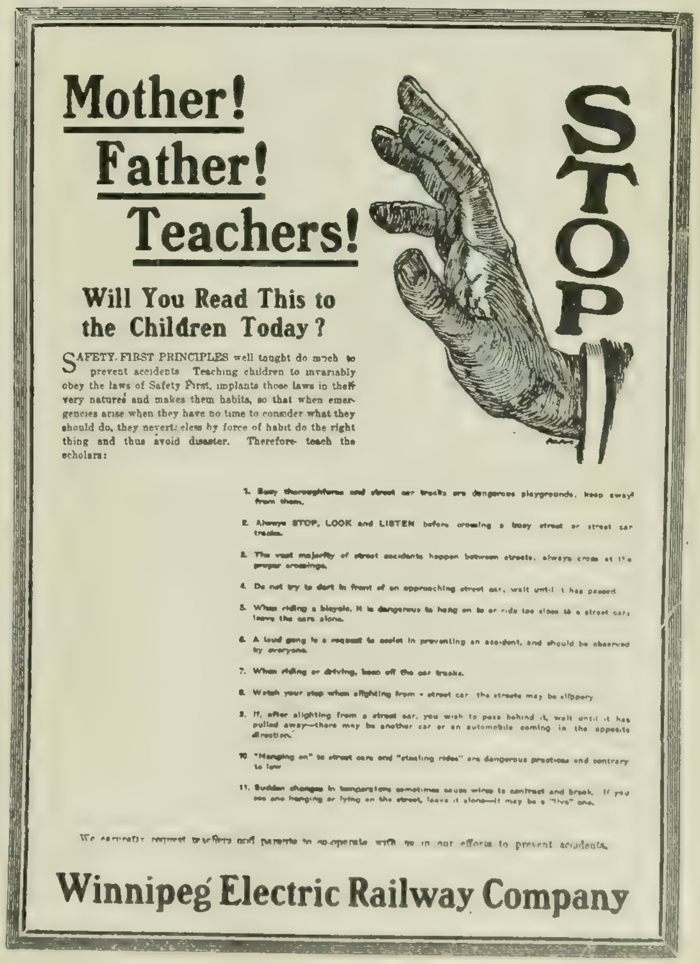
SAFETY FIRST PRINCIPLES well taught do much to prevent accidents Teaching children to invariably obey the Laws of Safety First implants those laws in their very natures and makes them habits, so that when emergencies arise when they have no time to consider what they should do, they nevertheless by force of habit do the right thing and thus avoid disaster. Therefore teach the scholars:—

1 Busy thoroughfares and street car tracks are dangerous playgrounds, keep away from them
2 Always STOP, LOOK and LISTEN before crossing a busy street or street car tracks
3 The vast majority of street accidents happen between streets always cross at the proper crossings
4 Do not try to dart in front of an approaching street car wait until it has passed
5 When riding a bicycle, it is dangerous to hang on to or ride too close to a street car, leave the cars alone
6. A loud gong is a request to assist in preventing an accident, and should be observed by everyone.
7. When riding or driving, keep off the car tracks.
8. Watch your step when alighting from a street car, the streets may be slippery.
9 If, after alighting from a street car, you wish to pass behind it, wait until it has pulled away—there may be another car or an automobile coming in the opposite direction.
10 "Hanging on" to street cars and "stealing rides" are dangerous practices and contrary to law.
11 Sudden changes in temperature sometimes cause wires to contract and break If you see one hanging or lying on the street, leave it alone—it may be a "Live" one.

We earnestly request teachers and parents to co-operate with us in our efforts to prevent accidents.

WINNIPEG ELECTRIC RAILWAY COMPANY

The Winnipeg Electric Railway Company, as the accompanying illustrations show, are doing splendid work in helping to save the children. These are typical newspaper advertisements used by the company.



Mother!
Father!
Teachers!

Will You Read This to the Children Today?

SAFETY FIRST PRINCIPLES well taught do much to prevent accidents Teaching children to invariably obey the laws of Safety First, implants those laws in their very natures and makes them habits, so that when emergencies arise when they have no time to consider what they should do, they nevertheless by force of habit do the right thing and thus avoid disaster. Therefore teach the scholars:

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Winnipeg Electric Railway Company

The Dealer and Contractor

Toronto Electrical Contractors Hold Their First Get-together Dinner

The Toronto Electrical Contractors' Association held their first evening get-together dinner at the Carls-Rite Hotel, on Thursday evening, Oct. 4. There was a good attendance, and there is every indication that the association is receiving the hearty co-operation of its membership, and, in consequence, is meeting with very great success. The president, Mr. K. A. McIntyre, was in the chair, and, with the assistance of the secretary, Mr. J. Everard Myers, handled the various items of business most expeditiously.

As will be remembered, this organization drafted a constitution and set of by-laws some months ago, which made provision for a substantial membership fee and annual dues sufficient to carry on the necessary work of a live organization. The wisdom of this course is now shown in a substantial bank balance, which gives the association a standing and recognition it could not otherwise expect. Also it means that certain developments for the betterment of conditions under which electrical contractors in the city of Toronto have been operating in the past can now be proceeded with. A number of interesting topics were discussed at this first meeting, and it was noticeable that practically every member present undertook a full share of the discussion, so that good ideas were brought forward, and the conclusions reached were, as a result, based on mature judgment and the experience of a large number of members. There has always been a noticeable tendency among Toronto electrical contractors to get together and determine the actual cause of unfavorable conditions, and this was never more noticeable than at their opening dinner, and the result in this case, as on previous occasions, was that difficulties that looked formidable at first were arranged easily and amicably. Disagreements that electrical contractors may have with jobbers, manufacturers, or central stations are, in the vast majority of cases, the result of misunderstandings and capable of easy solution when all sides of the question have been viewed.

A minor detail of the evening's proceedings, though of special interest to the members, was the presentation to each contractor of a membership certificate, nicely framed, so that it may be hung up in a conspicuous place in his office. The president aptly remarked that it was the chief aim of membership in this association that each contractor should be assisted to make this certificate of real value to him in his business. It was, in effect, in the nature of a diploma, and if the members would all co-operate to give the association that standing in the community which it might have, they would be able to point with pride to this certificate as illustrative of the class of men they associated with and the class of work they performed.

The next evening dinner will be held in the Carls-Rite Hotel on [illegible] at 6.30 o'clock. No tickets are being sold beforehand, as the organization has now reached that stage when it is felt that each member receives such value for the evening spent that he cannot afford to be absent. Every Toronto contractor is urged to establish the habit as soon as possible of attending every one of these get-together dinners.

California Contractors Adopt Direct-Bid Plan

A new policy for direct bidding on electrical work has recently been adopted by the Electrical Contractors' and Dealers' Association of San Francisco, Cal., providing for the submission of bids to the architect or owner on all electrical installations costing $500 or more, with such bids to be opened at a specified time and contract award made. In explaining the new method of operation for members, the association says:

"Efforts have been made in the past to impress upon the persons and firms to whom electrical contractors submitted bids for electrical work that such bids represented considerable expense and labor and should be treated as confidential, but for some unknown reason this is not found to be the case.

"In line with our past efforts we find that the only remedy for the situation is to submit our bids to the architect or owner direct at some particular date, time, and place. In order that this matter may not be unwieldy to the architect or owner, we have limited such bids to $500 or over, or, in other words, on all electrical work costing $500 or over the bids shall be given direct to the architect or owner and none other.

"Accordingly, no electrical contractor member will submit any bid for electrical work the cost of which is $500 or more, except direct to the architect or owner or his representative, who shall set a date, time, and place for the receipt of such bids, and at which time and place such bids shall be opened. The contract for the electrical work shall be awarded to one of the contractors whose bid has been received at such time and place."

Artificial Daylight

In a paper recently delivered before the Illuminating Engineering Society on the recent progress in incandescent electric lamps and lighting, mention was made of the two types of "daylight" lamp, namely, with blue glass and with dense blue glass. The only difference in the two is that the latter is especially suited for photographic work, in that the dense blue glass removes practically everything but the actinic rays which are the rays that affect a photographic plate. For photographic purposes, therefore, it appears to be immaterial as to the length of exposure.

Mention was also made of the use of amber bulbs. Small lamps in which the bulb has been turned an amber color, are now in process of development. These will be used for decorative effects in the home, in that it will be possible to simulate the color of a candle, the kerosene lamp, or the old carbon filament lamp. It was intimated, however, as unlikely that any definite line of these lamps and bulbs would be placed on the market until the various electrical societies had come to an agreement concerning the most suitable colors .

In the discussion which followed, W. H. Robinson made the point that in the business districts in many large cities the canyon conditions cause the natural illumination during even mid-day hours to be decidedly inadequate in many cases. By the use of the "daylight" lamp, it is now quite possible to reinforce the natural illumination with artificial light. In this case the artificial illumination intensity should be raised to double the tabulated requirements as prepared for night lighting, inasmuch as the conflicting color differences and intensities in the natural lighting detract from the efficiency of the artificial lighting. This apparent anomaly was explained by the fact that the pupil of the eye is stopped down much smaller under daylight conditions than under artificial lighting conditions, even though the daylight itself may be inadequate, and the eye, therefore, is incapable of adjusting itself to artificial light in the presence of even imperfect daylight conditions. In augmenting natural with artificial light, the "daylight" lamp has shown itself very useful, especially in the lighting of large areas, such as offices and work rooms. Operators under this system of illumination have been found in many cases to prefer the artificial illumination to the natural, and in any case the transition from natural to artificial light is unnoticeable. In so far as color work is concerned, it has also been found in a great many instances that no appreciable difference in artificial and natural color effects has been found when the artificial illumination from the "daylight" lamp has been used.

Handsome Fixtures in Princess Theatre, Toronto

The recently completed Princess Theatre in Toronto is a most up-to-date and well-equipped playhouse. Care has been taken to have its appointments in keeping with the most advanced ideas in theatre equipment, and a very attractive interior has resulted, the effect produced being one at once of luxury and refinement. Naturally, the lighting of a theatre is one of the most important features of its equipment, since it may mar or enhance to a great extent the beauty of the whole house. In the case of the Princess Theatre, excellent taste and workmanship has been shown in this regard. The lighting fixtures are attractive, but not obtrusive, and blend harmoniously with the other decorations of the house.

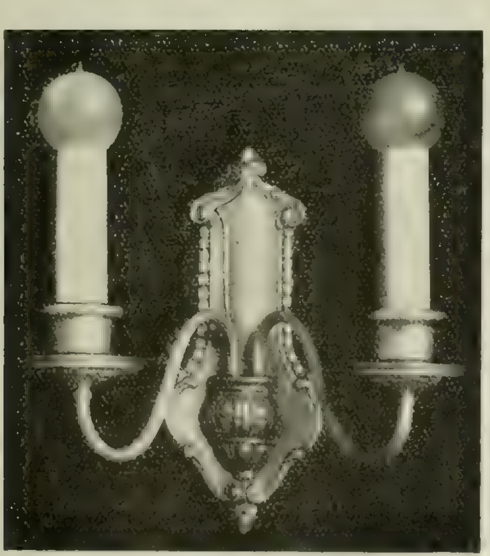


Fig. 1—Wall bracket in auditorium.

All fixtures have been designed after the Adams style, eighteenth century period, and a number of them are illustrated herewith. The chief feature of the whole lighting installation is the large fixture shown in Fg. 2. There are three of this type in the building, suspended from the ceiling of the main auditorium. The metal is of brass, the brass work being richly decorated and finished in an old gold tone. These fixtures are five feet wide from candle to candle, and their height from the lowest extremity to the lower end of the suspension chain is 7 ft. 5 in. The upper portion is octagonal in effect, there being eight curved arms from which the candlesticks extend. As may be seen in the illustration, the lower portion, suspended from the arms of the upper section is more or less an individual fixture in itself. At the bottom is a diffusing bowl, the light filtering through an amber plate underneath, while around the larger brass ring are also a number of lights. There are in all seventeen lamps on this fixture—eight on the candlesticks, eight around the circumference of the brass ring, and one in the diffusing bowl. The bulbs are all of amber glass.

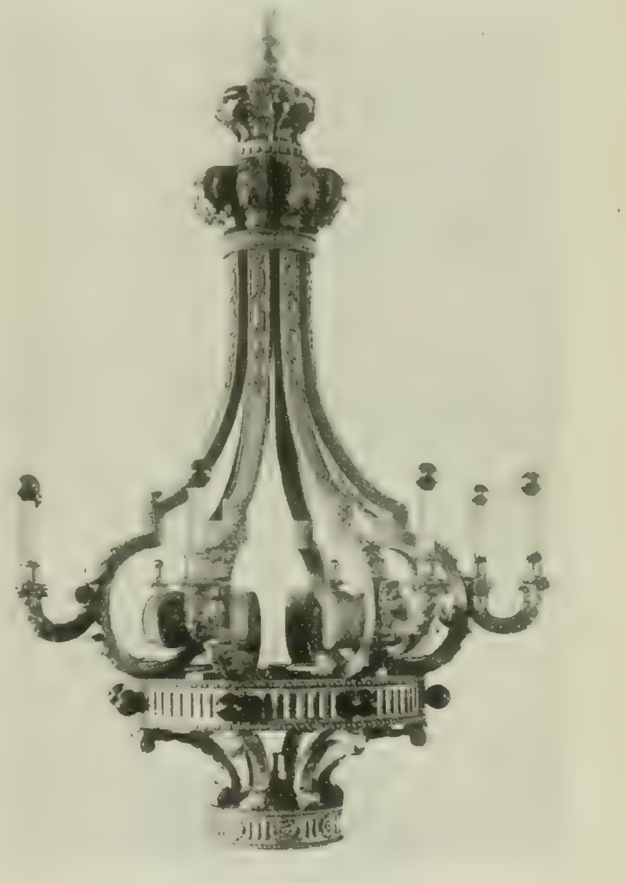


Fig. 2 – Ceiling fixture for main auditorium.

In addition to the three large fixtures, there are four corner lights, one at each corner of the centre ceiling panel. These latter fixtures are similar to the lower portion of the larger fixtures only suspended from the eight brass arms.

Fig. 1 shows one style of bracket used. There are a number of these along the walls of the auditorium, also in the foyer on the main floor. A different type of wall bracket was used in the mezzanine. This is shown in Fig. 3. There are four of this style, and old rose shades are used over the amber bulbs. The brass work on all these brackets, as elsewhere throughout the theatre, is finished in old gold tone, and the bulbs are amber colored. These amber bulbs produce a very pleasing effect, the light being soft and clear without glare

In the auditorium, underneath the balcony, there are eight ceiling bowls. These are of Adams design, etched with blue and white medallion, the plaque being Wedgewood blue

There are also a number of bowl fixtures, in the entrance lobby, of the same type but urn-shaped. The remaining fixtures in the entrance lobby are four-candle wall brackets.

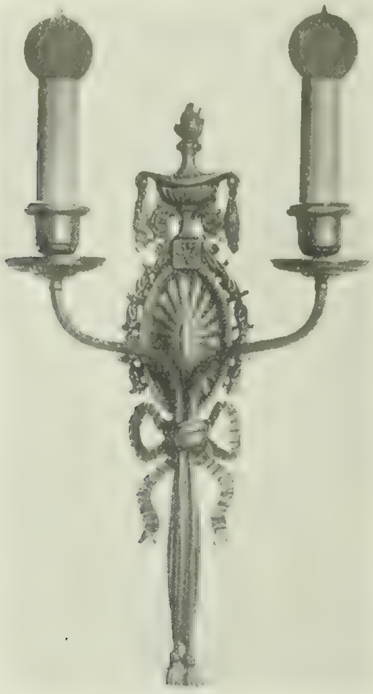
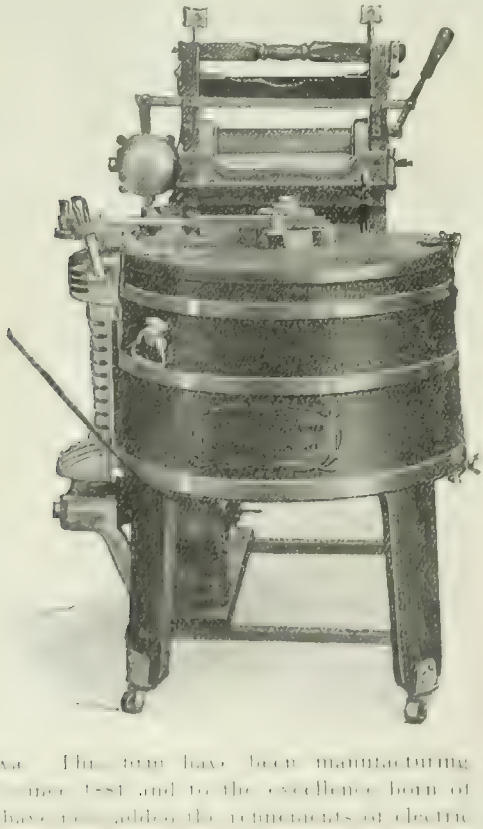


Fig. 3—Wall bracket in mezzanine.

McDonald & Willson, Queen Street East, Toronto, designed and manufactured the lighting fixtures for the Princess Theatre, described above.

The "Perfection" Washer

The washing machine shown herewith is the "Perfection" electric, manufactured by J. H. Connor and Sons, Limited, of Ottawa. This firm have been manufacturing washing machines since 1881 and to the excellence born of long experience have now added the refinements of electric drive.



"Points to Remember" in Electric Cooking

One of the best-known manufacturers of cooking ranges in Canada is McClary's, of London. This firm is now manufacturing a wide variety of electric ranges in which they have incorporated the experience of years in manufacture, with ease of regulation, sanitation and dependability of electric control. Their various designs are described and illustrated in a booklet entitled, "McClary's Electric Ranges and Appliances." A special feature of the ranges is a patented, separable, removable, switch-panel unit; the switches and cut-outs are mounted on a single, separate panel, forming an independent unit, so that the whole panel may be removed from the range. An interesting illustration in the booklet also describes the correct system of wiring for electric ranges. The equipment manufactured by this company includes hot plates and air heaters of different types.

McClary's little booklet also includes a number of "points to remember," such as:—

After baking, the oven of the electric range should be left open to allow it to become thoroughly aired and dried.

Be sure that elements are not operating when not in use. One element left on all night will cook your meals for two days.

Assist the free circulation of heat in the oven by using a dish that will not touch both sides and back.

Only use perfectly flat-bottomed utensils which will cover entire surface of boiling element, thereby using all heat generated.

Use cover on all utensils when cooking on electric ranges.

Use a damp (not wet) cloth wrung from soap and water to clean the elements.

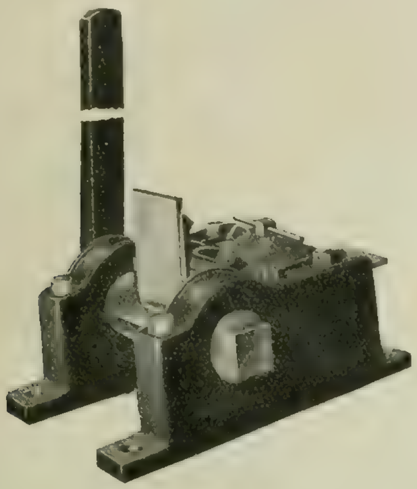
Be careful not to allow your oven to overheat. Should the oven reach a higher temperature than the thermometer will register, the hands of the thermometer will not come back to zero and cannot be relied upon afterwards.

Operating the elements on a high or medium heat when a low heat will do the work means waste of current. Water cannot be raised above 212 degs. F., no matter how hard you heat it; therefore you gain nothing, but you are wasting current.

Allowing food to boil over onto the element, especially liquids having sugar in them, harms the element. If salt or other dry material falls into the element, blow it out.

Bus Bar Bending Machine

There are many bus bending devices and machines in use in the hands of the different companies doing electrical construction, many of which have been developed on the job because of the lack of acquaintance with a standard machine for the purpose. One device, originating in the field as indicated above, has been standardized, and is shown in the accompanying illustration. This machine bends all copper bar sections up to and including six inches in width and three-eighths inch in thickness. The bar is run through the bed and clamped firmly in place. The operation of the bending arm causes a generous bending jaw to carry the bar end up to a true right angle or any inside angle more obtuse. The adjustable top holding clamp may be set, allowing for slight spring back, so that with any one section of bar any number of right angle bends may be reproduced by the complete travel of the operating lever. The bending jaw does not roll or wipe the moving portion of the bar, but simply follows it through the bend. This feature relieves the possibility of the piece sliding through the machine bed after commencing the bend. By use of the gauge face on the rear end of the machine any number of pieces may be bent with proper allowance, so that they will lie together evenly spaced in a stack after bending. The machine shown is manufactured by the General Devices and Fittings Company, of Chicago.



Station Control for Multiple Street Lighting Units

A device has been developed by the Canadian General Electric Company for controlling street lighting circuits when units are operated from commercial or house lighting transformers with station control circuits by means of a low voltage d.c. series circuit; thus making the system one of low voltage and eliminating extra transformers. The station equipment consists of the following items:—D.P.D.T. knife switch and resistance; reactance; constant potential transformer; aluminum cell rectifier. The line equipment includes the following items:—Reactance (in cast iron switch box); polarized relay; closing solenoid; opening solenoid; contacts; 2300 volt, 30 ampere, D.P.S.T. oil circuit breaker.

The diagram connection for all these items is shown in the figure. To close the 2300 volt oil circuit breaker, which may be located any distance from the station, close the knife switch in the station on the closing side for five seconds, then open the knife switch and leave in open position. To open the 2300 volt oil circuit breaker, close the knife switch on the opening side for five seconds, then open and leave it in open position. In both cases, direct current impulse has been sent through the 2300 volt line, ground, reactance and relay. It has, however, gone through the relay in opposite directions in the two instances, causing it to close on the lower contact in the first case, thus energizing the closing solenoid with 110 volt alternating current. The oil circuit breaker is closed, the contacts of the closing solenoid are opened and the contacts of the opening solenoid are closed. In the second case, the relay is closed on the upper contact, the opening solenoid is energized and the operation reversed. On grounded neutral systems the switch in the grounding line must be temporarily opened while the control impulse is sent.

Among the advantages of this system may be noted—strong construction of switch; ample power to operate heavy parts; absolute reliability; negligible attention to switch while in service; auxiliary circuit under control of station operator at all times; a number of switches can be controlled simultaneously by the station operator; no flicker in house lights while switch is being operated; as the operation is not controlled by a clock mechanism, it is no longer necessary to visit the switch at frequent intervals to reset it to conform with a constantly changing schedule.

Cragg Brothers, Limited, 151-3 Barrington St., Halifax, N.S., announce that they have established a new department of their business to be devoted exclusively to electrical goods and supplies. This company have been in the electrical business to a limited extent for a number of years, but have now secured the services of an experienced electrical man and will develop this department vigorously.

The Ward Leonard Electric Company of Mount Vernon, N.Y., manufacturer of electric controlling devices and vitreous enamel insulation resistance units, announces that it is now represented in Detroit, Mich., by the Electrical Specialties Company, 69 State Street.

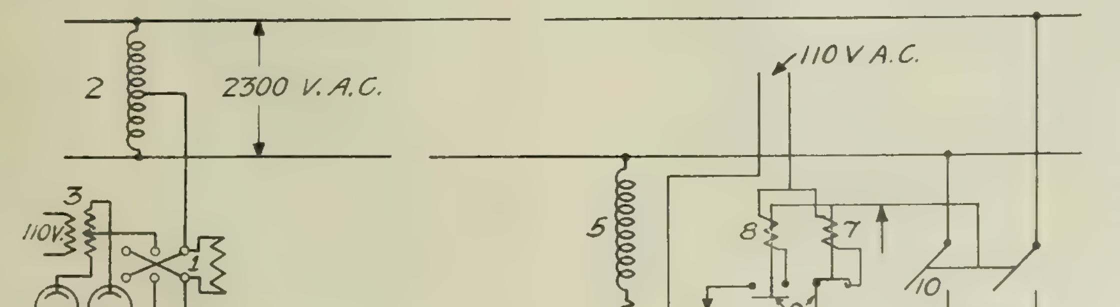
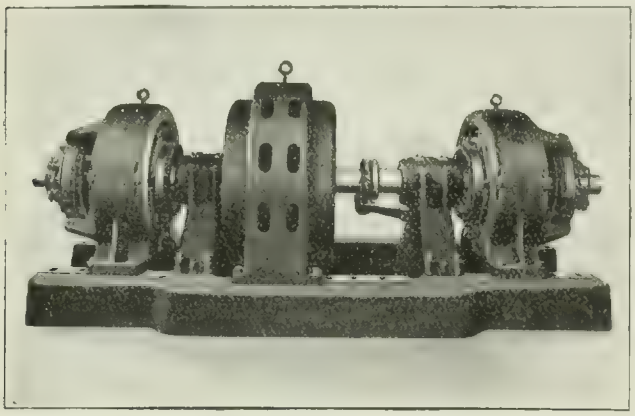


Diagram of connections for controlling street lighting circuits.

Two-Bearing, Three-Unit Motor-Generator Sets

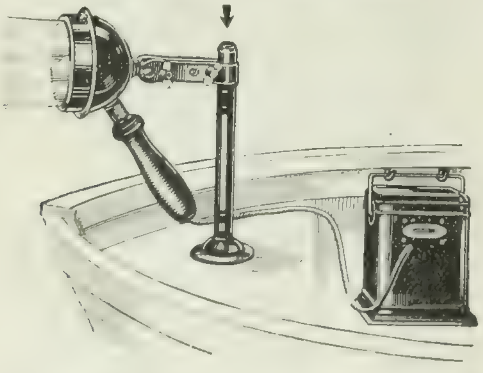
Two large rubber manufacturing companies have each recently installed two three-wire, direct-current motor generator sets that in construction are a departure from the usual practice. Instead of being of the old four-bearing, three-unit type or the two-unit type with a three-wire generator as one of the units, these sets consist of three units with only two bearings. The sets, which were designed and built by the Crocker-Wheeler Company, Ampere, N.J., consist of a 845 kv.a., 2200-volt, 60-cycle, 3-phase synchronous motor driving two 250-kw., 125-volt, compound-wound interpole generators.



The use of three units results in greater unbalance overload capacity and greater flexibility of the direct-current voltage than is obtainable with a two-unit set having a three-wire generator as one of the units. As compared with the old four-bearing, three-unit construction, these two-bearing units are much simpler in construction and have the following advantages: the absence of outboard bearings makes the brushes more accessible for adjustment and the unit can be assembled, dismounted and cleaned more readily. Perfect bearing alignment can also be secured with greater ease as self-aligning bearings are used. The machines can, therefore, be erected with less labor. Because of the shorter length of the set less floor space is required. Couplings which in some cases constitute a weak link are eliminated.

Delta Searchlight

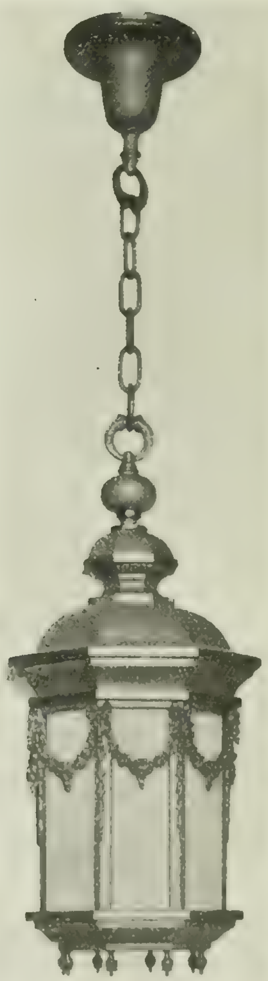
The illustration shows a Delta No. 5 boat searchlight, which operates on two No. 6 batteries. It is finished in weatherproof enamel and is fitted with a pedestal, which has a hole for a flag. The battery case either sets or hands. This searchlight is easily slipped off the bracket for a utility seat light. The same lamp may be fitted to the windshield of a Ford or other car for spotlight purposes, and is instantly detachable for use as a trouble lamp. The reflector is a powerful silver-plated parabolic type, 3¼ inches in diameter. C. Jackson, 22 College Street, Toronto is agent for Eastern Canada.



Handy Electric Table Stove

One of the handiest electrical devices on the market today is a small portable, inexpensive cooking and heating appliance called a table stove. It can be used anywhere a lamp socket attachment is available generating at a simple turn of the switch a clean, powerful, flameless heat—all of which can be utilized without smoke, soot or danger of fire, explosion or asphyxiation. The Hughes No. 5 table stove—manufactured by the Hughes Electric Heating Company, Chicago, is recommended by its portability, low operating cost, absolute cleanliness, safety and high efficiency. It has hundreds of miscellaneous uses in homes, restaurants, hotels, cafes, laboratories, training camps, drug stores, buffets, domestic science schools, dormitories, light housekeeping rooms, nurseries, sick rooms, bachelor quarters, hospitals, clubs, studios, summer homes, doctors' and dentists' offices, and any number of similar places where cooking or heating must be done in a limited space. In the home it means electric cooking without the expensive installation cost of the large range. It is controlled by a one heat switch conveniently located for use at the table. Comes equipped with rubber tipped legs and a heat shield to protect the table.

Mr. George C. Peters, Moncton manager for the New Brunswick Telephone Company, died suddenly on October 4.



Handsome lantern design by Tallman Brass and Metal Company.

The Trojan Washing Machine

The Trojan washing machine is manufactured by the McDonald & Willson Company, and is illustrated herewith. This machine has a powerful motor capable of operating both the cylinder and the wringer at the same time without fear of overloading. There is also installed a new and patented mechanism by which the cylinder reverses at every revolution, thus greatly increasing the agitation of the water which washes the clothes more quickly. A little booklet that is now being distributed by the company publishes some comparative figures which show, by economies that may be effected over the old way of washing, that the "Trojan" will pay for itself in less than two years.

In these days of labor shortage and high wages, anything which will make life easier and happier for the housewife is eagerly sought. Of the various work in a home, there is probably nothing the average woman dreads so much as washing, and for this reason the electric washer appears to fill a need in the home almost more than any other single piece of electrical apparatus. It may be justly argued that it pays for itself if it saves time, lightens the labor, makes it possible to do with less help or makes it easier to keep the help you have—and all these things may surely be claimed for the electric washer in its present state of efficiency.

Headlight Reflectors

One of the most troublesome problems of motoring today is the securing of a headlight which will provide ample light to illuminate the roadway for a considerable distance in front of the car without at the same time causing such a glare as will dazzle the eyes of a driver coming in the opposite direction and make it impossible for him to steer a careful course. Almost innumerable devices have been placed on the market, including dimmers, diffusers, hoods, etc., but one of the most satisfactory, and which appears also to conform with the legal requirements of this country, is the tilting lens manufactured by the Benjamin Electric Mfg. Co., of Canada. This headlight is illustrated in Figs. 1 and 2, Fig. 1 showing a vertical section view and Fig. 2 the effect of a tilted headlight on a dark night. In Fig. 2 the car in the foreground on the right-hand side of the picture is the one on which the tilting reflectors are being used, and these are at full angle tilt. The two cars seen dimly in the background at the left of the picture are about 75 feet distant. There is practically no light distributed above the fender of the car and consequently no glare above the line. The full intensity of the light, however, is concentrated upon the roadway, where it is most needed.

This type of headlight appears to offer more advantages than other types and to be open to fewer objections. With either the dimmer or the diffusing lens the difficulty is that the amount of light directly in front of the car is reduced. With the dimmer this means very inefficient lighting, and with the diffusing lens it means that both sides of the roadway are receiving the light which should be concentrated on the road. The big advantage in the tilting reflector, therefore, seems to be that the full intensity of the light is concentrated on the space between the advancing and the approaching cars—the very point where it is most needed to avoid collision.

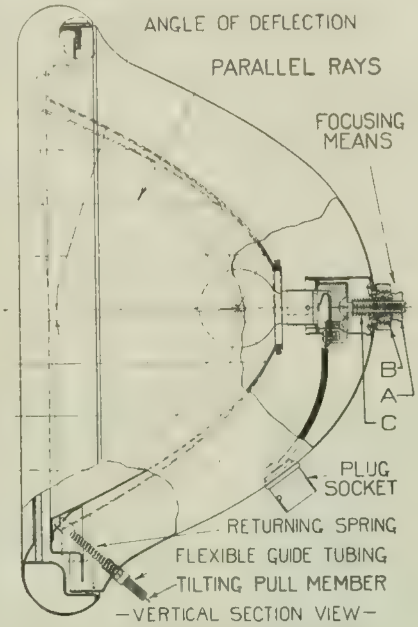


Fig. 1—Vertical section view of headlight.

Such a type of headlight will also prove of special value in rough roads. The motorist who finds himself in difficulty needs a light immediately in front of him, the very thing the fixed headlight will not give.

Another disadvantage with the fixed reflector is that on reaching the crest of a hill, either ascending or descending, if the dip is at all sharp, the light is shot up and away from the road immediately in front of the car. This makes it necessary for the motorist to feel his way until his car is brought into alignment with the roadway in front of him. This would be entirely done away with using the tilting reflector, which could be brought down to such an angle as to illuminate the roadway, however sharp the dip may be.

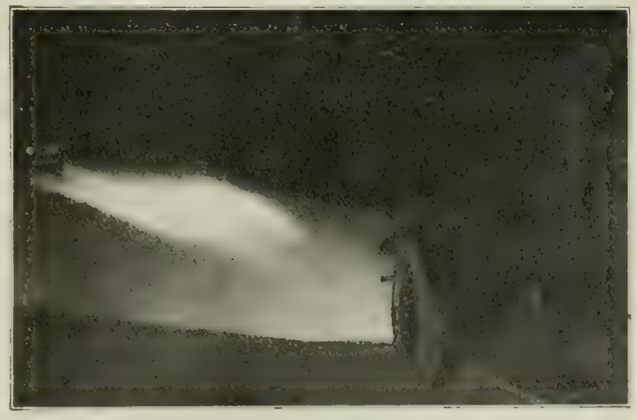
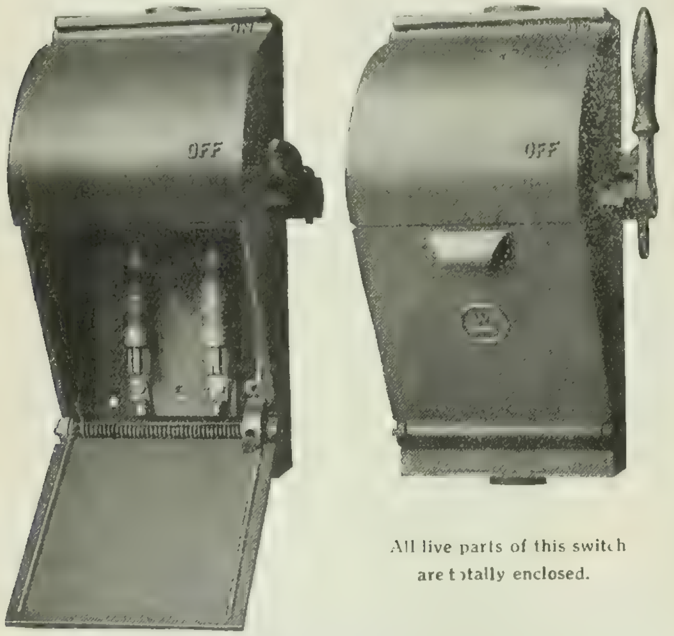


Fig. 2—Effect of tilted headlight on a dark night.

A Real "Safety-First" Switch

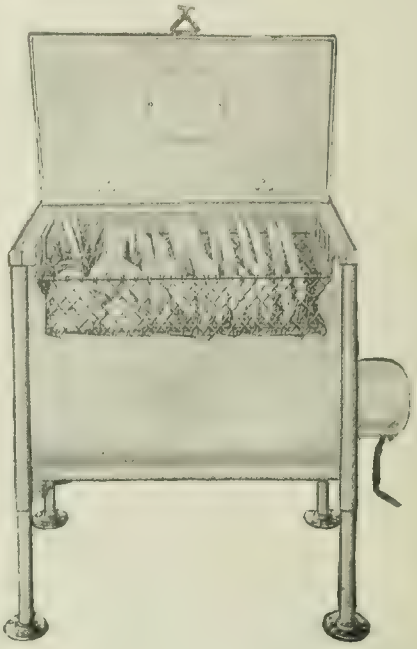
In steel mills, factories, mines, and similar places, employing men with practically no knowledge of electricity and its attendant risks, the need for an absolutely safe switch has become a necessity. The real safe switch is one so constructed that all live parts are totally enclosed and inaccessible. Means should also be provided for preventing operation by unauthorized persons. The switch shown, which has been brought out by the Westinghouse Company, is typical of the real safety switch. Its use assures the maximum protection implied in the word "safety." The complete device consists of an ordinary single-throw knife switch and enclosed fuse holders mounted in an exceptionally strong cast iron box, with an operating handle outside the housing. The box is designed for conduit connection and has a partition separating the switch blades from the fuse holders. The upper or switch compartment can be opened only by removing two machine screws. This compartment should never be opened except when making connections, or in case of inspection or repairs, as the switch is opened and closed by the operating handle, from the outside, through a shaft and lever inside the box. The lower or fuse compartment, containing the fuses and fuse holders, is the only part of the switch that need be opened, and then only to replace blown fuses. The door of this compartment is so interlocked with the switch by a vertically acting push rod which engaged a boss on the fuse-compartment door, that it can be opened only when the operating handle is in the off position and the circuit broken. Furthermore, with the door of this compartment open it is impossible to close the switch. Thus, the danger of a live line is eliminated. The operating handle can also be locked with the switch in the open position, preventing tampering by unauthorized persons.



All live parts of this switch are totally enclosed.

The "Minit" Dishwasher

An electric dishwasher of practical and sturdy construction is announced by Kitchen Service Company. Under the basket containing the dishes, as shown in the picture, is a square shaft to which are attached propellers or scoops. This shaft is connected directly to the motor by means of a spur gear, which means highest conservation of power. As the shaft is revolved at approximately 600 revolutions per minute, the water is thrown with great force upward and around the dishes in the basket. Every surface is cleansed and every trace of food particles, grease and accumulations of any kind removed. Breakage is practically impossible for the reason that the hot water comes in contact with all surfaces, inside and outside, at the same time, and the expansion is fairly equalized. The machine is of decidedly rigid construction. The body is 24 gauge steel—all joints and corners are welded



—the legs are standard 1-inch wrought iron pipe, securely welded to the angle iron frame work—the propellers are riveted to the shaft and all parts are rust-proofed. The electric motor is enclosed with the housing which the picture shows, protecting it from splashing, and also safeguarding the children. The finish of the machine is baked-on white enamel, which with the nickel trimming results in a handsome machine in keeping with the finest kitchen equipment.

An Interesting Comstock Booklet

The Canadian Comstock Company, Ltd., Montreal and Toronto, electrical contractors, have issued an illustrated booklet and a bulletin describing briefly work recently carried out. The contracts include many large industrial and power plants, commercial and public buildings. The booklet gives illustrations of the installation of various equipment, with short explanations. In an introduction the importance of the building owner selecting competent engineers and contractors is emphasized. "The owner must not overlook the fact that contracting service is not a commodity which can be examined and tested before it is paid for; he will not be able to tell whether he has received full value for his money until the work is completed. He must safeguard his interests by employing a contractor who has not only the qualifications for successful work, but who has a record for doing that work right."

Illumination Data

The George Cutter Company are distributing two interesting booklets. One of these is descriptive of Cutter's Arcadian and Suburban ornamental posts and also contains considerable engineering data in connection with the installation of street lighting equipment. The second booklet is called the "Cutter Handy Wiring Table and Illumination Data," and has been prepared for the purpose of giving useful information to electrical contractors, shop electricians, wiremen, etc. These booklets should be specially valuable to those planning new lighting systems or the modernizing of old ones.

Oil Fuse Cut-Outs

The D. & W. Fuse Company, of Providence, R.I., have just published an interesting catalogue describing their different types of oil fuse cut outs. The catalogue notes the well-known weakness of high tension enclosed fuses and describes wherein this new equipment removes the uncertainty of operation which has caused so much trouble in the past. The principles of operation are the same in all sizes manufactured by this company, but in the 25 amp. cut-out some slight modifications of a structural nature are made. By these changes a reduction in size and weight is obtained without sacrificing general efficiency or safety. The construction of the oil tank, the shape of the carrier and feeder oil connections are modified somewhat in the small cut-out and a threaded in, pressed-steel oil tank is substituted for a cast iron one.

New York Jovians Plan for Entertainment of National Convention

Arrangements are going forward for an unusual and interesting national convention of the Jovian Order to be held at the McAlpin Hotel, New York, Oct. 22-23. On Monday noon, Oct. 22, the local Jovian League will entertain all visiting Jovians at luncheon. The orator of the day will be Dr. Carl Wallis Petty who will deliver a patriotic address. Special entertainment features are being arranged for this local luncheon, under the leadership of George Williams. Monday afternoon the business sessions of the convention will be opened by H. L. Doherty, Jupiter of the Order. On Tuesday morning the business sessions will be opened by an address by John W. Lieb, president of the National Electric Light Association, who will speak on the general conditions in the electrical industry at this time. Of the thirteen constitutional amendments to be presented at the convention several embody vital changes in the existing method of operation of the Jovian Order. For this reason more than usual importance is attached to the annual gathering.

Disposal of B. C. Water Powers

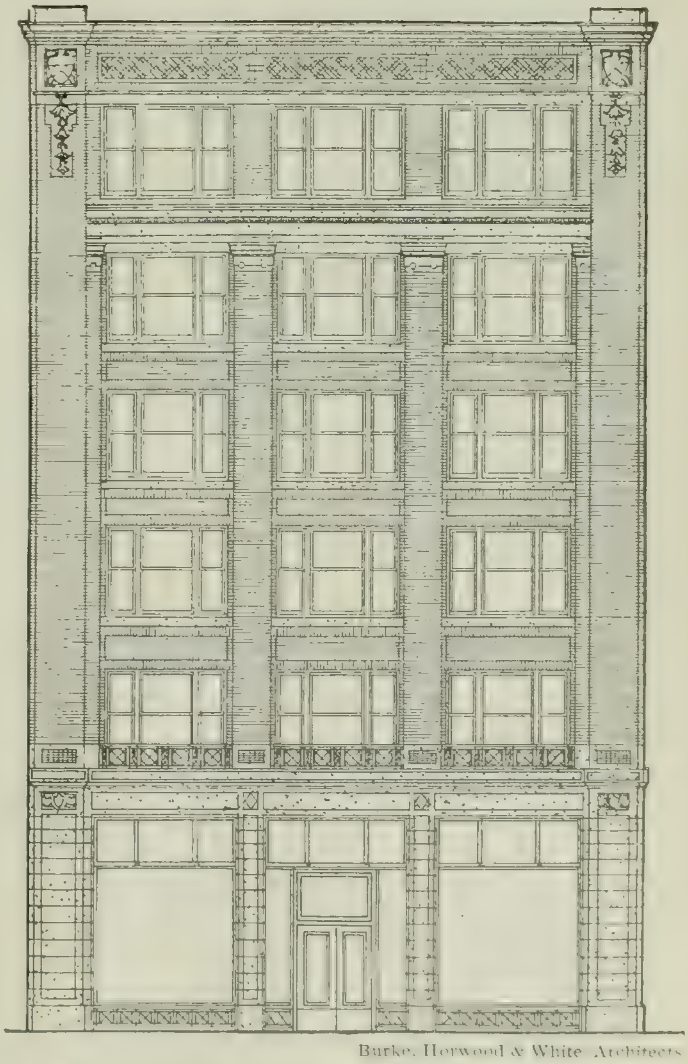
Representatives of local water power companies in possession of undeveloped properties recently interviewed Hon. T. D. Pattullo, Provincial Minister of Lands, to urge that the companies be protected in their investments although they were in arrears with their royalties or some other conditions of their lease. They expressed the belief that British Columbia was on the eve of a great industrial development through the demand for products secured by the electrolytic process and that there were others in the field ready to seize water powers that might be in default. They said they only wished to secure a reasonable return on their foresight and years of waiting and that it had cost considerable money to hold the leases and conform with the conditions imposed. The Minister replied that the government had no intention of being unfair to individuals but the water powers must be administered for the general public good. Companies investing in water rights to hold for future profit must stand on their own feet and pocket losses, and he could not promise any reduction in fees or royalties or give any blanket assurance to protect the holders. He thought it was clear that when some of the companies obtained their water rights the development period had not arrived and he doubted if development was in sight for all the water powers taken up in the province. Mr. Pattullo said, however, that companies which could show bona fide expenditure with value for the money which had been put in should be shown leniency by the government. The government would not be party to asking development companies to pay more for water powers than could be shown to exist in actual value and legitimate expenditure by the present holders of the rights. The deputation comprised Messrs. Adolphus Williams and W. R. Bonnycastle, Bridge River Power Co.; C. Gardner Johnson, H. K. Dutcher, A. Bethune and J. Lane, B. C. Power & Electric Co., Cheakamus; W. H. Leckie and Dr. L. N. MacKechnie, Campbell River Power Co. Some of the members of the deputation also represented the Ritchie Agnew Power interests at Stamp Falls and Indian River power interests.

Trade Publications

Enclosed Switches—Folder by the Detroit Fuse & Mfg. Company, describing their "square D" steel enclosed switches. The switch mechanism is operated by a handle outside the box and a safety lock-off prevents the switch being closed while repairs are being made to the equipment it controls.

Electric Ware—Electric heating and cooking appliances, such as flat-irons, toaster stoves, percolators, milk warmers, radiators, immersion heaters, and solder pots are described in Catalogue 8-C just issued by the Westinghouse Electric & Mfg. Company, of East Pittsburgh, Pa. The "Sew-Motor" for sewing machines is also described.

Moonstone—Catalogue No. 4. issued by the Jefferson Glass Company, Toronto, illustrating and describing heavy pressed Moonstone illuminating glassware, also blown Grecian lanterns and Canteloupe balls. The company is also issuing Catalogue No. 5, showing other forms of blown Moonstone ware. This company has recently opened a fine show room at 164 Bay Street, Toronto.



Burke, Horwood & White Architects

New warehouse being erected for the Canadian General Electric Co. at 211-216 King Street West, Toronto

Current News and Notes

Brandon, Man.

The sale has been completed of the properties of the Brandon Electric Light Company and the Brandon Gas and Power Company to the Canada Gas and Electric Corporation. G. A. Paterson, who for the last twenty-five years has been managing director of the Brandon Electric Light Company, has been appointed general manager of the new corporation's properties in Brandon.

Calder, Alta.

Electric light and telephone services are being extended to the district of Calder, Alta., in accordance with the agreement made when they amalgamated with the city of Edmonton. About one hnudred connections will be made.

Calgary, Alta.

By a substantial majority the ratepayers of Calgary, Alta., recently passed the majority report of the "one-man car" committee. "Safety cars" will now be a permanent feature of the Calgary Municipal Railway.

Edmonton, Alta.

The Edmonton Milling Company are installing a 75 h.p. motor, and will change from steam drive to municipal electric service. An additional motor will probably be installed at a later date.

Electric drive having proved satisfactory in the sash and door factory of W. H. Clark & Co., Ltd., Edmonton, Alta., they have recently added a 30 h.p. motor for a fan, this being their last steam-driven equipment.

The Canadian Northern Railway have under consideration an additional 100 kv. a motor for their roundhouse and shops at Edmonton.

Having reached ten thousand kw. h. per month power consumption, the Grand Trunk Pacific Railway shops now secure a rate reduction under their agreement with the Edmonton Electric Light and Power Department.

A large apartment block—the Leamington, Edmonton, Alta.—on which construction has been stopped for about two years, is now being completed. Each suite is wired for an electric range.

Fort William, Ont.

By a vote of 548 to 82 the ratepayers of Fort William recently ratified a by-law to enter into an agreement with the Hydro-Electric Power Commission of Ontario.

Hamilton, Ont.

City Electrician V. K. Stalford, of Hamilton, Ont., reports that they have been quite busy recently inspecting wiring installations for electric ranges which are replacing natural gas

London, Ont.

A net surplus for the first nine months of the year of about $19,000 is shown in a statement of the electrical department of London, Ont. The manager, Mr. E. V. Buchanan, stated that from the figures, which he regarded as very conservative, the net surplus for the year will be about $30,000. All interest charges, sinking fund, and depreciation have been taken care of. The gross surplus to date is $45,000, in spite of the 15 per cent. reduction made in the commercial and power rates early in the year.

Louth Township, Ont.

A canvass has been made in the district between St. Catharines, Vineland, and Jordan, and it is expected that sufficient contracts will be secured to warrant the construction of a line to serve this district with Hydro power.

Moose Jaw, Sask.

The City Council of Moose Jaw, Sask., have under consideration a change-over to one-man cars in order to relieve the shortage of labor situation and, at the same time, lessen operating expenses.

Niagara Falls, Ont.

The Hydro-Electric Power Commission of Ontario has denied the city of Niagara Falls, Ont., permission to build a submerged dam in the upper Niagara River for the purpose of supplementing the city's water supply. It was pointed out that every gallon of water was urgently needed for power purposes, but later on, when the Chippewa development was completed, arrangements would be made to supply Niagara Falls with a sufficient amount of water. In the meantime the city will be allowed to supplement its supply from the Ontario Power Company's conduit.

Omemee, Ont.

A distributing system for the town of Omemee is being erected, and the work will be completed in a short time. Power will be served the village by the Hydro-Electric Power Commission of Ontario through a 44,000-volt outdoor substation.

Perth, Ont.

The Hydro by-law and a by-law to purchase the local electric power company was carried in Perth, Ont., by a large majority.

Peterboro, Ont.

It is proposed by the Utilities Commission of Peterboro, Ont., to remove all arc lights from the city's streets and substitute more modern lighting units.

Port Colborne, Ont.

The municipalities of Port Colborne and Humberstone, Ont., are considering the question of signing a contract with the Hydro-Electric Power Commission of Ontario. These municipalities are at present being served by the Ontario Power Company, which owns and operates the distribution systems in both places.

Sarnia, Ont.

The City Council of Sarnia, Ont., have passed a by-law authorizing a temporary loan of $35,000 to the local Hydro-electric commission.

Saskatoon, Sask.

The city of Saskatoon will request the Saskatchewan Government to amend the present legislation governing the operation of street railways so that the city may, if it is so desired, operate some, if not all, of its street cars on the one-man system.

Toronto, Ont.

Mayor Church, of Toronto, as head of the Ontario Municipal Electric Association, has wired Premier Borden and the Minister of Railways and Canals protesting against the granting of application for a dam on the St. Lawrence River at Cornwall. The Mayor pointed out that most of the water available for power purposes was on the Canadian side of the river. This waterway, he said, should be reserved for the towns and cities of Eastern Ontario, and not given to a private corporation.

Curtailment of street and sign lighting is being considered by the Hydro-Electric Commission during certain hours in order that the necessary power be assured for the production of munitions and war material.

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Generation, Transmission and Application of Electricity

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ADVERTISEMENTS

Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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A Lesson in Organization

Readers of the Electrical News will no doubt be interested in the report regarding the reorganization of the National Electrical Contractors' Association in the United States, printed elsewhere in this issue. It is not always wise to imitate, but live electrical men will study and analyze every forward movement that is inaugurated in the industry, whether it be by a competitor or a sister organization. And Canadian electrical men, in their efforts to improve and perfect their representative organizations, will do well to note the steps taken by the National Electrical Contractors' Association, considering the ideas put into practice in the light of conditions existing in Canada.

We do not limit this advice to the contractor and dealer alone, for commercial relations are such that a movement of this nature affects the whole industry. No branch of the electrical trade can successfully form for itself a self-contained and independent organization. It is only as it takes into consideration its relations with other branches of the industry and their mutual responsibilities towards each other that it can achieve beneficial and definite results.

This basic fact has been taken into consideration in the reorganization of the National Electrical Contractors' Association. Its scope has indeed been widened in every sense. As indicated by its newly-adopted name, "The National Association of Electrical Contractors and Dealers," dealers are now admitted to its membership. It provides also for an associate membership of those who retail electrical supplies as a department of their business. Perhaps the most important step, however, is the provision for local, district, state, and divisional sections and meetings. By this subdivisional arrangement it will be possible for every member to share fully in the benefits of the association, as there will be a complete chain of communication from the central governing body to each local unit. This plan is certainly an ideal one, but it demands the most hearty support and co-operation of the members to be successful.

There will no doubt be difficulties to overcome as the new arrangement comes into effect. It is always the case that the broader the scope of an organization the more effort is required to get it under way, but just in that proportion is its influence the stronger and its benefits the more lasting.

"Organization" and "co-operation" are now time-worn and battle-scarred words, but it seems there is still a stiff battle to be fought before there is complete victory along that line in the Canadian electrical field. Perhaps the biggest difficulty in this country is presented by the fact that our population is scattered over such an immense area, but all the more on this account is the association spirit needed to bind the trade together. The subject is endlessly discussed, but familiarity must not be allowed to breed contempt. Let us always keep the benefits of organization in mind. It acts as a flywheel to industry, and, while it is difficult to set in motion, when once in full operation it adds an impetus which may be felt by every man in the business.

Montreal Electrical Luncheon Club Reorganized for 1917-18 Season

The Montreal Weekly Electrical Luncheon held their first meeting for the 1917-18 season on October 17, Mr. W. H. Winter presiding. The attendance was very large. The proceedings were entirely of a business character, with a discussion on a special report of the committee regarding the future policy. The report, read by the chairman, was to the effect that the following had been appointed as committee for the coming season:—Messrs. S. W. Smith, Electrical Equipment Co., Ltd.; J. McMillan, C. P. R. Telegraphs; A. C. Towne, Electrical Equipment Co., Ltd.; W. B. Shaw, Montreal Electric Co., Ltd.; A. Carroll, Eugene F. Phillips Electrical Works, Ltd.; P. T. Davies, Southern Canada Power Co.; H. Hulatt, Grand Trunk Railway; C. Thomson, Fred Thomson Co., Ltd.; J. A. Shaw, C. P. R.; W. H. Winter, Bell Telephone Co.; E. N. Hyde (chairman of Papers Committee), Northern Electric Co.; C. Duncan, C. Duncan Electrical Co., Ltd.; L. S. Humes, G. N. W. Telegraph Co.; W. J. B. Drew, Montreal Public Service Corporation; W. F. Graves, Montreal Tramways Co.; J. W. Pilcher, Canadian General Electric Co.; C. F. Medbury, Canadian Westinghouse Co.; R. J. Beaumont, Shawinigan Water & Power Co.; G. C. Read, Montreal Light, Heat & Power Co.; T. H. Chennell (secretary-treasurer), Bell Telephone Company.

It was decided that the luncheons should be continued on the same lines. Mr. Davies having declined the chairmanship of the Papers Committee, owing to having to be out of town more or less, it was resolved that the members of the committee should arrange for speakers and a provisional list of 24 talks has been arranged for. In order to vary the proceedings, a different member of the committee will act as chairman. Mr. Winter, the present chairman, has been elected president, and will name the chairman.

The committee discussed ways and means of meeting the expenses. As no membership fee was charged during the past season, it was decided to place this matter before the members because the funds received from several of the large corporations and companies were not sufficient to meet the expenses. It was suggested that a dollar should be contributed by each member, such members to become "members of record." The committee appealed for a high average attendance.

The discussion was practically confined to methods of financing the luncheons, and the advisability of making the luncheons an organized body. The concensus of opinion was in favor of continuing on the old lines without a hard and fast organization. It was also decided not to make any definite membership fee and to leave it to the members to contribute whatever sums they desired, together with contributions from corporations and companies, in order to meet the expenses. This involved the negativing of the suggested "members of record." The following took part in the discussion—Messrs. Hulatt, Pilcher, Hyde, Hill, W. B. Shaw, C. Thomson, Duncan, and Williams. On the motion of Mr. Teele, the appointment of the committee was confirmed. Mr. Hulatt proposed, and Mr. W. B. Shaw seconded, the appointment of Mr. Winter as president. This was unanimously agreed to.

Economical Advantages Employing Low Grade Steel for Transformers

It is often said that a body of technical men will turn out with far greater alacrity to a smoker or other social event than to hear a lecture dealing with some scientific problem. This theory was certainly not borne out by the assembly which gathered under the auspices of the Toronto section of the American Institute of Electrical Engineers on Friday, October 19, to hear Mr. Frank T. Wyman's paper on "Transformer Design." Over sixty were estimated to be present in the Engineers' Club lecture room, not less than ten of whom took an active part in one of the livest discussions which that room has ever heard.

Poor Quality Steel Advantageous

Mr. Wyman is no rule-of-thumb designer, and his paper was highly technical, but not on that account any the less interesting. By mathematical analysis he deduced equations for the volume of the steel and the volume of the copper in a transformer as related to the quality of the steel, and further showed that for high voltage transformers of large output the quality of the steel has remarkably little effect on the cost. In other words, a given efficiency can be maintained and the cost of the transformer very little influenced by the adoption of steel of a relatively inferior grade. Indeed, in view of the considerable cost of the extra high grade silicon steels at the present time there would appear to be economical advantages in employing a poorer quality.

Such a paper as the above confirms us in our high opinion of the useful work which the Toronto section of the A.I.E.E. is doing. It is a high tribute to the section when an expert engineer presents the result of his work before it preparatory to submitting it to headquarters, in New York.

High Price of Gasoline Increases Use of Electric Vehicles

The high price of gasoline (it is now costing more than $1 per imperial gallon) and the multiplying of electrical supply stations are said to be creating a new demand for electric vehicles for both pleasure and commercial purposes in the United Kingdom. It is not supposed that such demand can be met by British manufacturers, so long as their energies are being devoted to supplying government needs, but after the close of the war there will in all probability be a marked development along this line, since to maintain and operate certain electric vehicles will be more economical, there is much less noise while running on the road, and there will be standardization of construction. It is thought that through standardization it will be possible to construct a two-seated runabout complete for less than $500, and a half-ton tradesman's van for about $750.

Electric Vehicles Improved

A writer in a recent number of the Electrical Times says that the gasoline car came to the front because of the inefficiency of the first electric motor cars with their cumbersome machinery, unsatisfactory batteries, and inadequate facilities for recharging. To-day the situation is quite changed. Simplicity of operation is one of the outstanding features of the electric vehicle; and, given the correct voltage and the needed apparatus, any car owner can recharge his batteries from his house current. As a result, there are now 1,000 commercial electrics in use in this country against one-sixth that number before the war. Railroad companies are using them extensively, and in other lines of business, as well as for municipal use, the demand for them can not be met. In some cities electric power has been adopted for omnibus service. At pre-war rates for gasoline the relative over-all costs of running petrol and electric omnibuses worked out practically 17 and 15 cents per car-mile. The cost of gasoline has advanced 250 per cent., whereas the advance in cost of electric energy has been only about 10 per cent. At many places in England power for commercial electrics can be obtained for 2 cents per unit. An electric passenger car travels nearly, if not quite, a hundred miles on a single battery charge.

With the return of normal conditions it is quite probable that, for long distances with few stops, gasoline will still offer the greater efficiency, but for short distances with frequent stops electric motor cars will be the more economical.

Women Drive Electric Taxicabs

By A. Jackson Marshall

A significant indication of the growing shortage of men chauffeurs is embodied in a recent advertisement of the Detroit Taxicab and Transfer Company, of Detroit, for women to operate their electric taxicabs. The "copy" indicates that feminine drivers would only be employed during the day, between 7 a.m. and 6 p.m., and that they will receive exactly the same schedule of wages as the men.

As the company states, experience is unnecessary, since the driver of an "electric" needs only a few hours' training to become thoroughly competent. The ease of operation of the electric vehicle, the simplicity of its mechanism and consequent infrequent disorders and repairs, together with its cleanliness, noiselessness, attractiveness and speed, have made it particularly successful in this line of work.

This advertisement offered a splendid opportunity for woman to "do her bit," and the Electric Vehicle Section, National Electric Light Association has been advised by the Detroit Company that over 500 patriotic women have applied for chauffeur's positions, and that several are already operating their electric taxicabs with great success.

The electric taxicabs of Detroit have enjoyed continued success for three years, and the fleet has been increased from one to nearly one hundred cars. Chicago is also the home of a prosperous fleet of electric taxicabs. Twelve cars were put into service in April to supplement twenty gasoline cars, but the "electrics" have practically displaced the gas-cabs, as patrons constantly request them. St. Louis also has its fleet of successful electric taxicabs. In addition to other advantages the cost of operating electric taxicabs is about half the cost of the gasoline type.

The Fair Wage Board, Winnipeg, Man., have decreed that electrical workers shall receive 55 cents an hour instead of 50.

Lighting and Power Systems in Paper Mill

Details of Installation in Extension to St. Maurice Pulp and Paper Company's Plant at Cap de Madelaine, Que. - Special Machine Room Circuit

The St. Maurice Pulp & Paper Company recently added to their Three Rivers mill a complete paper making plant, with a capacity of 100 tons per 24 hour day. The new structures include a wood room and conveyers, screen room; diffuser and digester rooms; evaporator, recovery and causticizing building; acid plant, boiler house, machine room (equipped with two 166 inch Pusey & Jones Fourdrinier machines), and finishing room.

Power is supplied at 55,000 volts, 60-cycle, 3-phase, by the North Shore Power Company. The service is taken from the power line to an out-door sub-station, where the voltage is reduced to 550 volts by three 611 kv.a. single phase transformers. From the transformers 550 volt service cables are carried to a new 12-panel Westinghouse switchboard, located in the extension to the motor room. The board controls all the power and lighting circuits to the new buildings (with the exception of the lighting circuits in the wood room, which are fed from the old switchboard); also the power circuits to the new motors which were installed in the motor room and wet machine room.

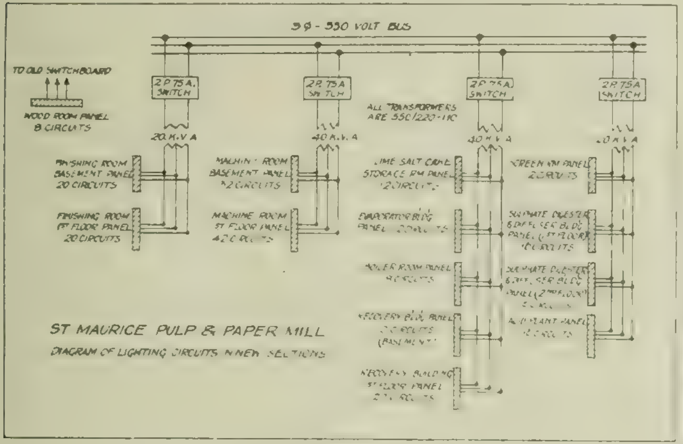

3Ø - 550 VOLT BUS
TO OLD SWITCHBOARD
WOOD ROOM PANEL 8 CIRCUITS
2P 75A. SWITCH
2P 75A SWITCH
2P 75A SWITCH
2P 75A SWITCH
ALL TRANSFORMERS ARE 550/220-110
20 K.V.A
40 K.V.A
40 K.V.A
20 K.V.A
FINISHING ROOM BASEMENT PANEL 20 CIRCUITS
FINISHING ROOM 1ST FLOOR PANEL 20 CIRCUITS
MACHINE ROOM BASEMENT PANEL 12 CIRCUITS
MACHINE ROOM 1ST FLOOR PANEL 42 CIRCUITS
LIME SALT CAKE STORAGE RM PANEL 12 CIRCUITS
EVAPORATOR BLDG PANEL
BOILER ROOM PANEL
RECOVERY BLDG PANEL (BASEMENT)
RECOVERY BUILDING 1ST FLOOR PANEL
SCREEN RM PANEL
SULPHATE DIGESTER & DIFFUSER BLDG PANEL (1ST FLOOR)
SULPHATE DIGESTER & DIFFUSER BLDG PANEL (2ND FLOOR)
ACID PLANT PANEL
ST MAURICE PULP & PAPER MILL
DIAGRAM OF LIGHTING CIRCUITS IN NEW SECTIONS

Diagram of lighting circuits.

The switchboard consists of one control panel with a 2,000 ampere automatic oil circuit breaker, time limit relays, voltmeter receptacle and bracket type voltmeter; one totalizing panel with polyphase watthour meter and graphic recording polyphase watt meter; eight power panels, each with a 3-pole, 300 ampere automatic circuit breaker, ammeter, indicating watt meter and ammeter receptacle; and two lighting panels, each with two 2-pole, 75-ampere, automatic switches and two single phase watthour meters.

Lighting Circuits

All lighting is single phase, three wire, and is equally divided among the three phases of the supply circuit. From the switchboard there are taken four 550-volt, single phase circuits to two 40 kv.a., single phase transformers, and two 20 kv.a., single phase transformers; the two 20's are on one phase of the 550 volt, 3-phase system, and a 40 on each of the remaining phases. All lighting transformers are 550/220-110 volt, and lighting feeders are taken from these to safety type lighting panels in the various buildings, the three-wire lighting circuits being carried from these panels. All wire is enclosed in rigid conduit. The lighting in the various buildings is as follows:

In the wood room, which is controlled from the old board, there are twelve 100-watt outlets.

In the screen room there are sixteen 250-watt lamps, located over the clay-mixing tanks, water filters, rotary diaphrams, screens, thickners, etc., and one 40-watt lamp over the stairway and the platform above the floor pit.

Diffuser and sulphate digester rooms: Eleven 100-watt lamps on each of the three floors and three 60-watts in the monitor roof over the digesters.

Blow pit building: Eight 100-watt lamps.

Sulphite digester building: Five 100-watt lamps on each of the four floors and three 60's in the monitor roof.

Acid plant: Eight 100-watt lamps on each of the two floors of the absorbing room; two 40's on each landing of the reclaiming tower, three 100's in the line room and four 200's over the sulphur burners.

Sulphur storage building: Eight 40's in the basement, eight 100's above conveyer platform on the main floor and one 40 for passage lighting under the platform.

Recovery building: Twenty 200-watt lamps on main floor, 56 outlets in the basement and 7 in the sub-basement.

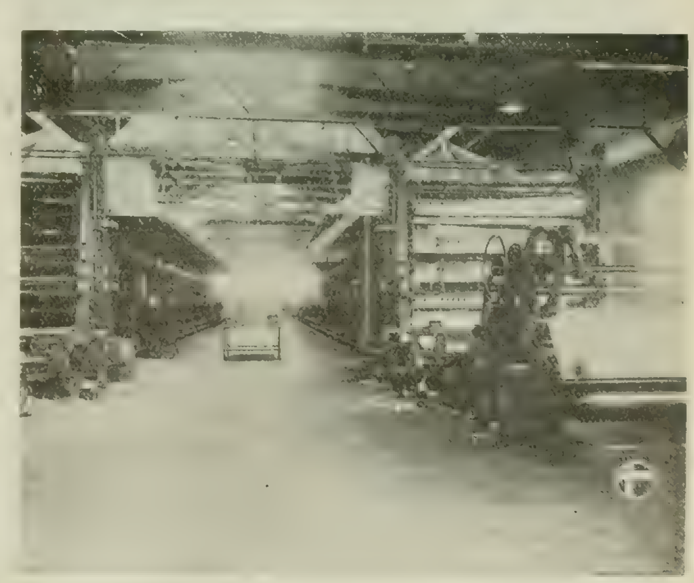
Causticizing building: Sixteen 200's on the main floor and 10 outlets in the basement.

Evaporating building: Eighteen 200's on the main floor and fifteen 200's in the basement.

Lime and salt storage building: Twelve 200's on the main floor, nine 100's in the basement.

Boiler room: Five 250's and seven 40's on the firing floor level and five 40's in the ash pit.

Machine room: In the machine room the lighting is somewhat more localized than in any other part of the plant. Outlets are located directly over the screens, rolls, Fourdriniers, calenders, etc., and are hung directly from the drying hoods. In addition to the local lighting there are a number of lamps suspended above the passageways for general illumination. In all there are 25-500's, 10-250's, 6-100's and 16-40's on the main floor of the machine room and 49-250's and



Paper machine shop, St. Maurice Pulp & Paper Company

3-100's in the machine room basement. In addition to the permanent lights there are nine 20-ampere receptacles located along each side of the machine room main floor for inspection and trouble lamps.

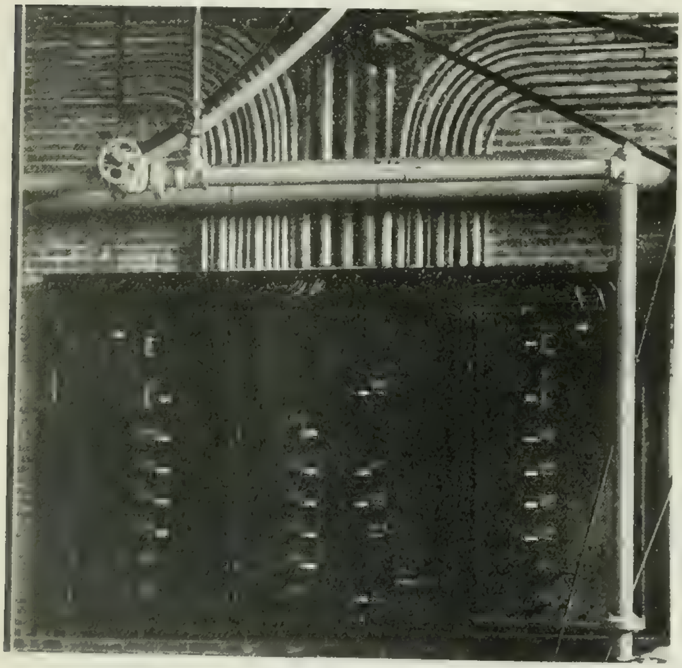
Finishing room—first floor: 10-500's and 11-250's. Basement: 13-250's, 21-100's. There are also four 250-watt lamps spaced on 24 ft. centres on the loading platform, and six 100-watt lamps on 16-ft. centres on the platform on the opposite side of the finishing room, also seven 20-amp. receptacles on first floor.

Power Circuits

There are eight power circuits, each originating from one of the power panels on the main switchboard, from which they are carried in conduit to control panels located in the various buildings. The motors on these circuits are as follows:

Circuit No. 1.—(Panel in Machine Room)

Jordan pulp pump machine	150 h.p.	
Calender blower	7½ h.p.	
Winders and slitters	40 h.p.	
Constant line drive	100 h.p.	
Machine screens	20 h.p.	
		317½ h.p.



Safety power panel in machine room.

Circuit No. 2—(Panel in Machine Room)

Duplicate of No. 1 for the other machine		
		317½ h.p.

Circuit No. 3—(Panel in Wood Room)

2 Chippers, each	125 h.p.	
2 Yard conveying blocks, each	20 h.p.	
Blower	2 h.p.	
		293 h.p.

Circuit No. 4—(Panel in Screen Room)

Sulphite screen	150 h.p.	
Filtered water pumps	85 h.p.	
Mixing tanks	100 h.p.	
Stock pumps	25 h.p.	
Diffusers cold water pump	15 h.p.	
		375 h.p.

Circuit No. 5—(Panel in Machine Room)

Clay mixing	15 h.p.	
Screen plate cleaning	35 h.p.	
Fresh water shower pump	50 h.p.	
2 Machine exhaust fans, each	15 h.p.	
Pulp beater	40 h.p.	
Stuff pump	5 h.p.	
Broke beater	35 h.p.	
Accumulator pump	2 h.p.	
Air compressor	20 h.p.	
(Sub-panel in Finishing Room):		
Elevator	20 h.p.	
Roll grinder	10 h.p.	
Pipe shop and core cutting	15 h.p.	
Rewinders	10 h.p.	
Repair Shop	30 h.p.	
		317 h.p.

Circuit No. 6—(Panel in Wet Machine Room)

Chip conveyor	15 h.p.	
Ground wood thickener	60 h.p.	
Main water supply pump	125 h.p.	
		200 h.p.

Circuit No. 7—(Panel in Lime Storage Room)

Slacking tank drive	5 h.p.	
Sulphur and lime conveyor	15 h.p.	
Lime tanks and pumps	35 h.p.	
Absorbing room drive	50 h.p.	
(Sup-panel in Causticizing Building)		
2 melt furnace blasts, each	10 h.p.	
Dissolving tanks motor	30 h.p.	
Causticizing tank motor	20 h.p.	
Causticizing liquor pumps	15 h.p.	
(Sub-panel in Boiler Room)		
Three motors, totaling	30½ h.p.	
		220½ h.p.

Circuit No. 8—(Panel in Screen Room)

Sluicing pumps	30 h.p.	
Digester filtering pumps	35 h.p.	
Elevator	10 h.p.	
Sulphite screens	60 h.p.	
Refiner	25 h.p.	
2 chip conveyors, totalling	50 h.p.	
Sulphate stock pump	35 h.p.	
3 water and liquor pumps, totalling	42½ h.p.	
		287½ h.p.
Total horsepower		2,328 h.p.

The circuit arrangement in the machine room is worthy of note. The motors are divided in three groups—(a) Those used exclusively with machine No. 1; (b) Those used exclusively with machine No. 2; (c) Those used for either or both machines. Each of these groups is on a separate circuit (circuits No. 1, No. 2, No. 5), and controlled through a separate panel board. This was done for the purpose of localizing any trouble which might occur, any accident to one machine, or one circuit not necessitating a shutdown of the other.

The electrical installation was made by the Canadian Comstock Company, Limited, Montreal. The consulting engineer was Mr. H. S. Ferguson, New York.

Electric Club of Toronto

On November 2 the Electric Club of Toronto will be addressed at its weekly noon-hour luncheon by Mr. Frank Stockdale, one of America's foremost retail experts. Professor Haultain, of the University of Toronto, has been secured as the speaker for November 23. Negotiations are in progress to secure speakers for the other November meetings.

Iron Transmission Lines for Rural Extensions

Many sparsely settled communities are deprived of electric service because central station companies cannot afford to build the lines to serve them. In fact, from data which have been collected, some rural copper-wire lines built to the standard used in well-settled districts have been unprofitable to the operating companies because the revenue obtained did not even pay for the overhead charges on the investment. In such cases, or where service is required for only a short period of years and the wire must be subsequently taken down, companies have had to look for cheaper methods of construction. Iron-wire transmission has been tried extensively of late, the companies taking advantage of the lower cost of conductors and the higher tensile strength which permits larger pole spacing and consequently smaller investment in poles and insulators. A recent issue of the Electrical World describes such a transmission system and considerations affecting its design as follows:

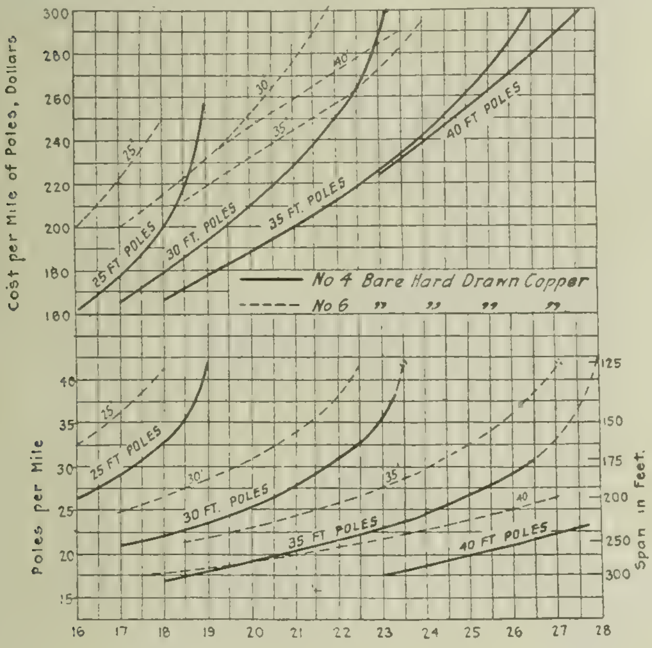


Fig. 1—Cost of poles per mile with two sizes of wire and different ground clearances.

Iron Wire for Certain Extensions

Seeing the possibilities in the use of iron wire, but being confronted with a state law which compelled it to secure the approval of the State Public Service Commission before such construction could be adopted, the Central Connecticut Power and Light Company has taken up the subject with the commission and received permission to use iron wire for certain extensions. At the time the request was made several 2,200-volt line extensions had been promised to customers along a 13,200-volt transmission line, it being the intention to put cross-arms on the existing pole lines to accommodate the proposed 2,200-volt circuit. This construction has not yet been approved, however, presumably because it has not yet been ascertained whether the high-voltage wires might break and come in contact with the low-voltage wires beneath.

At the conferences which were held the commission was alarmed lest the proposed types of construction should be more dangerous to the public than the present standard. In support of the petition it was shown that No. 6 bare double-galvanized B. B. iron wire is about one size larger and very much stronger than the commonly used No. 6 B. & S. gauge weatherproof copper wire. Iron wire has the further advantage of not having to carry a load of weatherproof insulation. Weatherproof copper wire is usually soft or medium drawn and much weaker than hard-drawn copper or iron wire.

Iron Wire Stronger

If weatherproof copper wire is pulled up taut during hot weather it will contract and become so taut in cold weather that the wire draws out to a slightly smaller diameter. In the winter, when it is loaded heavily with sleet and subjected to high wind pressures, the tension may become so great that it will lengthen the sag until the tension has been reduced. During the following summer, owing to the higher temperatures, the wires will sag still further. Iron wire supported on poles placed 250 ft. apart to give 6-foot sags is much stronger and much more likely to retain its original length and position than copper wire usually erected on more closely-spaced poles.

Evidence in support of these statements was given the commission by showing photographs of a trunk telegraph line supporting many wires on poles spaced 125 ft. apart, which had broken down during a winter sleet-storm, while three iron wires erected three years before by the operating company for transmission purposes and supported on poles in two instances 480 ft. to 500 ft. apart were unaffected. While the commission seemed to appreciate that poles which were not strong enough to support forty wires on short spans would support three wires on long spans, and that the pole loading was not excessive in the requested construction, approval has thus far been withheld for the long span.

In the three-year-old iron-wire line previously mentioned there have been no pole failures or broken wires, no insulators broken because of mechanical stress, and there has been only one cross-arm failure—that being due to a tree falling across the line and breaking the cross-arm from the pole. The cost of this line, including substantial payments for purchase and cutting of right-of-way and a small charge against engineering, was $517 per mile. It was composed of 35-ft. poles, two-pin cross-arms, and two No. 4 double-galvanized B. B. iron wires.

Liability to Rusting

In the opinion of the commission, there seemed to be no question as to the strength of galvanized iron wire when first installed, but the liability to rusting was viewed with some alarm. The petitioner held that iron wire can rust considerably before its cross-section is reduced to the point where it would be seriously weakened. If a small iron telephone wire is safe for ten or twenty years, the larger wires proposed for transmission purposes will, of course, have a longer life, since the larger the diameter the less the relative surface exposed to rust compared with the weight. Furthermore, although practically all 600-volt trolley wires suspended over the heads of pedestrians in busy city streets are supported by stranded galvanized-iron wire, casualties due to the rusting away of these wires seldom occur. While the commission was apparently satisfied with the initial strength of the proposed iron wire, it demanded, in granting permission for its use, that the

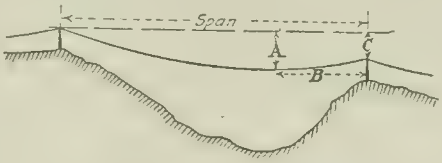


Fig. 2—Measurements taken to adjust sag on long span with poles at different elevations (see table II.)

Table I.—Sags (In.) Employed for Different Spans at Different Temperatures.

(No. 4 bare medium hard drawn copper wire and No. 4 double-galvanized B. B. iron wire.)

Temp.	Span (feet).						
deg. Fahr.	150	175	200	225	250	275	300
20	11	20	33	50	72	90	114
40	13	24	38	55	78	96	120
60	16	27	42	57	78	96	120
80	19	31	46	66	84	102	126
100	23	35	50	71	90	108	132

operating company use extra vigilance during the semi-annual line inspection.

Most Economical Pole Heights and Spacing

The results of the study made by the Central Connecticut Power and Light Company to ascertain the most economical pole spacings for the iron-wire line previously described are given in accompanying curves and tables. Selecting a given clearance of 18 ft. from the lowest point of the conductor to the ground, and using No. 4 bare conductors, it appears from Fig. 1 that seventeen 35-ft. poles are required per mile, whereas twenty-two 30-ft. poles must be used in the same distance. From the upper set of curves it can be seen that the 35-ft. poles cost $167 per mile, while the 30-ft. poles would cost $178, making the cost of poles for an 18-ft. clearance 6 per cent. cheaper with 35-ft. poles than with 30-ft poles.

With No. 6 bare conductors relatively larger sags would be required to keep the tension within safe limits. Twenty-one 35-ft. poles or twenty-seven 30-ft. poles would be required per mile with an 18-ft. clearance from wire to ground. In this case the pole cost would be $208 and $214 per mile respectively, a difference of only $6 per mile; thus it would hardly matter whether No. 6 bare conductors were supported on 35-ft. or 30-ft. poles.

It was assumed when this study was first undertaken that the most inexpensive line would be that built with the shortest poles, but reference to the upper set of curves shows that for an 18-ft. clearance the 25-ft. pole line of thirty-three per mile costs considerably more than a 35-ft. pole line with seventeen per mile. At the then existing cost of materials it is, therefore, evident that it is no more expensive to use No. 4 conductors with long spans than to use a smaller conductor with shorter poles.

Table II.—Data Used in Adjusting Sags With Poles at Different Elevations (No. 4 Iron Wire).

Span (ft.)	C (ft.)	B (ft.)	A (ft.)	Sag from low arm (ft.)
500	0	250	32.5	32.5
	10	213	37.8	27.8
	20	180	43.0	23.0
	30	148	48.0	18.0
	40	120	56.0	16.0
	50	98	62.0	12.0
400	0	200	19.5	19.5
	10	152	25.0	15.0
	20	110	31.0	11.0
	30	77	37.5	7.5
300	0	150	10.5	10.5
	10	85	16.1	6.1
	20	41	23.0	3.0
	30	13	30.8	0.8
275	0	138	8.5	8.5
	10	56	14.2	4.2
	20	23	20.2	0.2
	30	20	30.0	0

Pole-Top Construction

In Fig. 3 is shown the pole-top construction used on the Central Connecticut Power and Lighting Company's 13,200-volt three-phase line to Lyman Viaduct, Conn. This line has now been in successful operation for about four years. Thirty-five-foot poles are set 275 ft. apart on tangent right-of-way, farther apart over gulleys and closer together on angles. N. E. L. A. specifications were followed for telephone crossings, and the wires were made to clear paths and roads by 22 ft., the minimum clearance being 18 ft. In this way shorter poles are permitted where the span has to be short and where poles are on knolls. Where the poles are set in earth they are allowed to extend 5 ft. into the ground for 35-ft. poles. In rocky ground the holes are at least 4½ ft. deep.

Three wires are strung on the poles, one a No. 4 bare medium hard-drawn copper wire and the other two No. 4 double-galvanized B. B. iron wire. In stringing these conductors a target is attached to each arm to facilitate sighting along the line and securing the proper sag (given in Table I., under column marked "275 ft."). The wire joints were made with copper sleeves and the conductors were tied to the insulators with galvanized-iron wire. Special care was taken to avoid injuring the galvanized covering on the conductors so that rusting would not ensue. The poles are guyed with galvanized No. 4 iron wire except at crossings.

A three-phase 13,200-volt iron-wire line with an aerial ground wire which was constructed more recently is shown in Fig. 3. This line is interesting in that the poles were cut somewhat longer than usual to allow a 5-ft. extension at the top for attaching the ground wire, thus making it unnecessary to use an angle-iron bayonet as is usually done. The top of this extension, even if as small as 4 in. in diameter, is stronger than the customary angle-iron extension. Furthermore, it involves no extra expense and eliminates considerable additional material and labor.

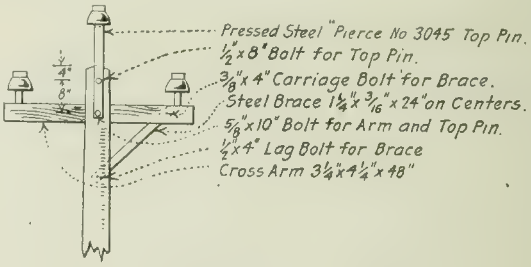

Pressed Steel "Pierce No 3045 Top Pin.
½"x8" Bolt for Top Pin.
⅜"x4" Carriage Bolt for Brace.
Steel Brace 1¼"x 3/16"x 24" on Centers.
⅝"x10" Bolt for Arm and Top Pin.
½"x4" Lag Bolt for Brace
Cross Arm 3¼"x4¼"x 48"
4"
8"

Fig. 1—Pole-top construction used on one 22,000 volt iron-wire line.

The method of "sagging" long spans where one supporting pole is higher than the other is shown in Fig. 2. This particular section is on a 13,200-volt line and is 500 ft. long, three No. 4 iron wires being spaced 6 ft. apart on the cross-arms. All of the sags are adjusted on assumption that the temperature will not exceed 80 degrees Fahr. To measure the sag a carpenter's level was held against the lower pole and shifted vertically until a line of sight along its upper edge was just tangent with the lowermost point of the span. (See Table II.)

In giving permission for the use of iron wire the Connecticut Commission stipulated that special attention should be given semi-annually to the inspection of any lines of iron wire, in order to detect and correct deterioration.

Its approval authorized the use of iron wire for transmission of electric current at normal voltages only under 4,400 bolts. There was a particular exception applying to a 13,200-volt line carried on a private right-of-way, in which case copper wire is eventually to be substituted for the iron.

The construction of a distribution system in Oil Springs will be proceeded with.

Development of a Permanent Street Lighting Plan for a Small City

By R. B. Thompson*

This paper is presented with the idea of describing the lighting work of one central station company after a close study of the principles and ideals of the Illuminating Engineering Society, rather than as attempting to show any new developments in the art of street illumination. It may be of some interest as showing the work that can be accomplished in cities similar to the one described. Previous papers have dealt almost exclusively with conditions in large cities, leaving the problems of smaller communities more or less untouched.

During the last few years the changes in the art of street lighting have been so great that practice which was standard a short time ago is now obsolete. Recent developments in the series incandescent lamp have allowed a larger number of sizes of lamps to be used, together with a greater variety of equipment. This has been of special benefit to the central station which serves a varied class of street and highway conditions.

The lighting systems that will be described are those of a company which serves a territory embracing about 600 square miles, including two cities each with a population of thirty odd thousand, together with a number of villages which range in population from 300 to 5,000. Parts of the intervening territory are farmland, while other parts are extremely rugged in character. Thus the company serves almost every type of community that is met in modern central station practice. Its street lighting is really divided into two distinct types—highway and village lighting, and city lighting, both of which have a few uncommon features.

Highway Lighting

Highway lighting has been developed not only in the communities where population is fairly dense, but also as a direct aid to the obtaining of service in localities which could not furnish sufficient commercial business to justify the cost. This lighting is supplied almost exclusively by 32 c.p. series lamps equipped with small bracket fixtures and radial wave reflectors. Some of the lines extend 15 to 18 miles. The service is paid for exclusively by the various townships that receive the benefit of the lighting, and is considered extremely desirable because of the lonely character of the country through which the highways pass. The traffic during the summer is heavy and as several of the roads shown are trunk highways it has been found necessary for the general good of the community to have the roads lighted.

Until recently, both cities, with the exception of ornamental zones on their main streets, were lighted exclusively by high powered units. One city still used the old 6.6 ampere enclosed lamp, while the other had already adopted the more modern 4-ampere magnetite lamps. The company had watched with interest the development of nitrogen-filled lamps, and, after their efficiency and durability had been demonstrated, recommended to the former city regarding their use for street lighting. After several conferences it was concluded that a detailed study should be made of the city's lighting requirements, and the most modern methods of meeting them. The company's engineers made this study and became convinced from their own experience, and knowledge of local conditions, as well as from the experience of others as presented in the transactions of the various engineering societies and other publications, that it is of much value to consider the following subjects in designing a plan for street lighting:

I. Reason for Street Illumination

The purposes of street lighting are:

1. To aid in keeping the peace.
2. To enable pedestrians and vehicles to avoid collisions or obstructions of any sort.
3. To ornament or improve the appearance of thoroughfares generally.
4. To act as an advertising medium and enhance trade.

II. Process of Seeing

In streets at night objects are seen by reason of contour, relief, shadow, or color.

Objects are perceived when they are markedly different in brightness from their background. Since most large objects at night are darker than their background, they are perceived usually as silhouettes.

Contrasts in relief are perceived when the exposed surface of an adequately illuminated object presents areas of different reflecting powers.

Small objects may be perceived by reason of their shadow. Shadows of large objects are not always of value but on the contrary are often misleading.

III. Natural Divisions of Street Illumination

White-way lighting:—In the downtown or business sections of cities, the illumination must be sufficient to accommodate a large and fast moving volume of traffic. This type of lighting is also a means of inducing people to pay regular visits to the retail district. With streets well lighted and show windows bright until 10 or 11 o'clock in the evening, people are attracted by the brightness and come to examine the goods on display or because they enjoy being with the crowd.

Lighting for business or factory streets:—For business or factory districts ample intensity is needed to enable truckmen quickly to read any memoranda, such as way bills, and to read street numbers easily. Such a street also requires good intensity to secure proper police protection, and to allow employees to pass easily and safely from their work after dark.

Residential or block lighting:—For residential street lighting it is usually better to use suspension units spaced at street intersections. For best results the spacings should not exceed 300 ft. The distinctly residential street does not require so high an intensity as the thoroughfare that leads out of the city.

"Sparsely settled district" lighting:—The roads in outlying sections are much less frequently used at night than the downtown streets, and usually only for vehicular traffic. Thus, 32-c.p. lamps at intervals of 300 feet are generally sufficient to indicate the way to travellers.

Park lighting:—The main objects of park lighting are usually to indicate the course of the park drives and pathways, and to enable the park to be efficiently policed. Usually lamps 10 or 12 feet from the ground are ample for this service.

IV. Types of Equipment

In white-way lighting the most common fixtures are standards of from one to five lamps. For normal block lighting a suspension type of unit is commonly used. If the lamps are hung at heights less than 18 ft. and refractors are used, the redirected light is of so high an intensity when it encounters the eyes of the traveller that it has a blinding effect. If the lamps are spaced at distances less than approximately 250 feet this is not the only undesirable feature. With such close spacing, light zones of greatly differing intensity are set up and these tend to prevent the sharp silhouette effect which is necessary to make objects distinguishable. For this reason refractors should be replaced by diffusing globes if at close interval and low heights. For "beacon lighting" either a bracket fixture, or, where the road is straight, suspension lamps spaced at long distances may be used.

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* Before Illuminating Engineering Society.

V. Illuminating Engineering Features

From the standpoint of illumination, street lighting should meet these tests:

(a) There must not be too much glare.

(b) Too great a uniformity of lighting must be avoided. The average intensity of all street lighting is very low, and if uniform it is exceedingly difficult to discover obstructions but if some areas are more brilliantly lighted than others, all obstructions are easily seen in silhouette.

(c) In all street lighting, the color of the road surface is an important consideration. Since the introduction of the practice of oiling roads, they have become considerably darkened. As a result, much higher intensity is needed to sufficiently illuminate them.

To this general principle, there is an exception in the case of hard, smooth paving such as brick, concrete and asphalt, whose reflecting power is largely increased by the small amounts of oil which drip from motor cars, and under the action of traffic impart to the pavement a polished film-like surface. This surface reflects the light of street lamps and enables objects to be seen in silhouette against the pavement as well as by the direct light of the lamps.

VI. Maintenance

It is always desirable to keep street lighting circuits, lamps and fixtures in first class condition. The appearance of many installations is marred because fixtures are poorly placed and their efficiency is often lowered by allowing insects, dust, etc., to collect in the globes and on the fixture.

In an incandescent lamp installation lamps should be renewed as soon as their candlepower is materially lessened by deposit caused by the disintegration of the filament. This decreased candlepower is more apparent when the old lamp is installed near a new one.

Principles Advocated

The principles discussed above led the company to recommend to the city that in its future street lighting plans, the following conclusions should receive consideration:

1. The "boosting" value of ornamental lighting makes it of primary importance.

2. High powered lamps should be used for general block lighting. They should be equipped with refractors if at a height of 18 ft. or more. If lower, a heavy diffusing globe should be used to avoid glare.

3. For outlying districts, small bracket fixtures with radial wave reflectors should be used.

4. A type of lamp should be adopted whose operating characteristics permit of the use of lamps of different sizes on the same circuit.

5. A concise but comprehensive plan of street and highway lighting of the entire district should be kept, not with the thought of installing this ideal as a whole, but simply as a goal toward which to strive. This general plan should be read at intervals and if necessary revised to permit of the latest improvements in apparatus.

PLAN ADOPTED BY CITY

The city instructed the company to make a comprehensive lighting plan which should follow these recommendations, and this was done in the following manner:

On large scale maps of the city the different existing lines and lamp positions were plotted. The engineer then visited each lamp position and made notes of the lighting requirements such as the immediate surroundings of the lamp, the type of street surface, the kinds of trees and heights of lowest branches, and any other information that he thought desirable.

In the drafting room, the ideal plan was designed and the charts were then taken into the field to be checked for possible errors. Small consideration was given to the cost of installation, as it was intended to be an ideal one from the standpoint of illumination.

The plan, when completed, was adopted as a whole by the city, and is presented in the following outline. The city was divided into six zones:

Zone 1.—Retail business district.
Zone 2.—The approaches to the city.
Zone 3.—Parks.
Zone 4.—Warehouse and manufacturing district.
Zone 5.—The settled residence district of the city.
Zone 6.—The partially settled districts.

Separate Equipment for Each Zone

The types of equipment for these zones were:

Retail business district.—Ornamental lighting.

Approaches to the city.—Either ornamental or extremely good block lighting.

Parks.—Single light standards.

Warehouse and manufacturing district.—Bracket lamps spaced at approximately 75 feet or extremely good block lighting so as to give sufficient intensity to permit reading of way bills, etc., at night.

Settled residential section.—Block lighting.

Partially settled districts.—Beacon lighting, i.e., small units spaced approximately 200 to 300 ft. apart.

Upon getting the approval of the city, the company installed two circuits of this ideal plan as an example of what could be accomplished. It is proposed to make the remainder of the system conform to the ideal plan in the course of the next few years.

Results

The results so far have been highly gratifying. The city was to turn over to the company all complaints regarding the new system. So far, only one person in the whole community has complained (an arc lamp was removed from near the front of his house, and replaced by a 40-c.p. lamp). From the standpoint of lighting, the effect has been very noticeable. Lamps are in alignment, properly spaced, and at the proper height, and the resulting excellent appearance is noted on all sides.

This in brief is the plan followed by the company in its installation of a modern system of street illumination. The results have been satisfactory to the community served and to the company. A comprehensive plan of lighting the whole system is now in existence so that future developments can be taken care of in a routine manner. It seems to prove that with a little care a lighting company can develop a modern system that is correct from the standpoint of good lighting, and secure the co-operation of the city and the goodwill of the public in making the change.

Personal

Mr. Geo. E. Chamberlain, who has been connected with the Canadian Machine Telephone Company almost since its organization, has been appointed manager of the exchanges at Burford, Brantford and St. George, succeeding Mr. H. E. Rose, resigned. Mr. Chamberlain is an expert in all matters pertaining to the automatic telephone, and was at one time the company's representative in Italy when an automatic exchange was installed in Rome.

Ontario Needs More Electric Power

Plan to Develop Coteau Rapids for Export Being Opposed by Commission of Conservation

A recent application to the Dominion Government by the "Power Development Company, Ltd.," to carry out a water-power development scheme at the Coteau Rapids, in the St. Lawrence River, recalls an apparently similar application of some years ago for a large development at the Long Sault. In the former case the Aluminum Company of America was generally supposed to be behind the scheme.

Comparatively little information appears to have been given in connection with the application, and, considering the shortage of power in Ontario at the present moment and the very probable continuation of this condition, it would appear to be of the greatest importance that a proposition of this nature should be more thoroughly investigated before any definite action is taken. Apparently Ontario can use as much power as we can get from our water-powers, and particularly, therefore, it would appear that if more power is developed on the St. Lawrence at the present none of Canada's share can be exported for use in the United States.

The Commission of Conservation were particularly active in their opposition to the former scheme, and naturally are anxious that the present proposition should be thoroughly investigated. To this end they have made representations to the Department of Public Works at Ottawa. The following communication, signed by Sir Clifford Sifton, chairman of the Commission of Conservation, sets forth the views of that body:

October 22 1917.

Sir,—The Commission of Conservation has the honor to address you on the subject of an application of "Power Development Company, Ltd.," made in pursuance of a notice published in the Canada Gazette on September 22, 1917. It is understood that this application will come before you on the 22nd October instant.

The application is for liberty on the part of the "Power Development Company, Ltd.," to carry out a water-power development scheme in the Coteau Rapids, in the River St. Lawrence, as a private commercial undertaking. It is understood that plans and specifications of the proposed development have been filed in your department.

Incidentally, the application contemplates the use of the dam which has been constructed by the government between Clark Island and Grande Isle. The right is also asked to use the entire water flow from Lake St. Francis, less any rights previously conceded or any water required by the government for canal purposes or lockage of vessels.

Nothing in the application indicates that the applicants contemplate the idea of offering to pay any sum whatever for the extensive privileges which are asked for or to compensate the government for the expenditure upon the dam which the applicants propose to appropriate for their purposes.

Disposal of Power

It is presumed that the applicants are asking for the privileges mentioned in their application for the purpose of carrying out a purely private commercial undertaking, and that, after the application is granted by the Minister of Public Works, the enterprise will be carried out as a commercial enterprise, and the power which is developed will be disposed of by the company wherever it can be disposed of to the company's best advantage from a financial standpoint, without regard to the interests of the Canadian public.

A great many considerations arise in connection with such an appilcation at the present time. It is to be noted, for instance, with respect to the power situation at the city of Montreal that the company which has heretofore been given the right to make use of the Cedar Rapids for purposes of power development has developed and marketed a very large amount of power, estimated to be about 100,000 h.p.

Of this amount of power, so developed purely from Canadian waters, the said company has sold and delivered to the Aluminum Company of America an amount of power varying from fifty to seventy-four thousand horse-power, having been authorized to do so by permit issued on April 1, 1916, which authorized the said Cedars Company to export up to 100,000 horse-power.

Being Sent Out of Canada

This enormous quantity of energy is being sent out of Canada, and is of no benefit whatever to Canada except in so far as the profits thereon represent dividends to a few shareholders of the power company. It is obvious, therefore, that whatever the power situation is in Montreal, there can be no shortage which is legitimately due to lack of power development. If a shortage exists it exists because this great quantity of power has been permitted to be exported to the United States. Moreover, it is stated that the extensions of plant now under way by the Cedars Company will produce an additional 100,000 horse-power or thereabouts, which will be available for use in a short time.

This is not the first time a proposal to dam the St. Lawrence has been up for consideration. In the year 1910 a company, which was believed to have been acting in the interest of the Aluminum Company of America, sought the power to dam the St. Lawrence River at the Long Sault, and the whole subject was most exhaustively considered in connection with that application. A hearing was had before the International Waterways Commission and protests against the project were then developed at length. Eventually the matter came before Parliament, and the whole subject was very exhaustively debated, with the result that the company's application failed, and nothing has been heard of the project again until the present application was filed.

Identity of Company Not Disclosed

There is nothing in the papers before you which really indicates who the responsible parties are that are filing the present application or for what purposes the power which it is contemplated to develop will be used. The company has been incorporated under the plan known to lawyers as an office company, the incorporators being the officials of a law firm in Montreal, and the capital, $500,000, is altogether inadequate for carrying out so ambitious a project.

Obviously, definite information should be furnished as to whom are the responsible promoters of the projects and what disposition it is proposed to make of the power which will be developed.

When the application heretofore referred to was up for consideration the Commission of Conservation filed an objection before the International Waterways Commission, in which the whole subject was discussed. The position was then taken that it was unwise and improvident to allow large Canadian water-powers to be developed with the object of exporting the power to the United States, because, although there might at the moment be no commercial demand for the power in Canada the time will undoubtedly come when the power will be required upon the Canadian side of the line.

Creates an Embarrassing Situation

If, in the meantime, power has been exported to the interests created in the United States on the basis of the use of this power, a situation has been created which will give rise to serious embarrassment. The industries and interests thus created are certain to look upon any attempt to withdraw the power from them as confiscation of their vested rights. They are quite certain to protest vigorously to their government against such withdrawal being permitted, and serious international complications may arise.

We are informed that a situation very similar to that thus indicated has arisen in connection with power development at Niagara Falls. The complaint is made there by Canadian industries that power which is properly applicable to Canadian industries is being exported to the United States in pursuance of arrangements made in former years, and difficulty arises in securing a cessation of this export of power.

In this connection we submit that it is in the highest degree unwise for the Governments of Canada and the United States to encourage the exportaton of power from one country to another when circumstances are such that in the near future each country will require all the power which it can legitimately develop or to which it is legitimately entitled. The subjects of the two countries will inevitably call for the intervention of the governments, and the result will be that international disputes will arise.

It is submitted that the power situation in the Provinces of Ontario and Quebec should be fully considered before any action is taken looking to the granting of private rights of the character sought by the present application.

Such consideration will show that the power situation has developed very rapidly within the last few years, and, so far from there being excess of power capable of being developed at easily accessible points, it is certain that within the next twenty years all the power that can be developed at points where the same can be conveniently used will be required for use in Canada.

The power situation is intimately related to the fuel situation. The question of fuel in the Province of Ontario is becoming an increasingly serious one and the time will come very soon when electric power will be largely used for the purpose of operating the railways in the Province of Ontario and for other purposes for which coal is at present employed. If a little consideration is given to the subject upon these lines it will readily be seen that it is improvident in the highest degree for vested interests to be created which may conceivably prevent the people of Canada from enjoying full and beneficial use of the water-powers which are the property of the public.

Many other considerations arise to which no reference has been made herein, but if an opportunity is permitted, no doubt the various interests affected will place their objections before you. In the meantime we suggest that no action be taken without giving the fullest opportunity for discussion.

Yours faithfully,
(Signed) Clifford Sifton,
Chairman.

That the situation is already critical at many points in this province is instanced by the threatened difficulties in Toronto, where the Board of Control recently authorized the Mayor to forward the following telegram to Ottawa:

"Toronto facing a very critical situation owing to inability of Hydro-Electric Power Commission of Ontario to supply necessary electric power for munition plants and war purposes and normal demands. We respectfully urge you to pass an order-in-council or secure an interim report from Sir Henry Drayton on the subject to cover the shortage, as an immediate temporary emergency measure. Immediate action imperative or we will have to cut street lights and munition plants will also suffer."

Mr. H. E. Rose, who has for the last nine years been associated with the Canadian Machine Telephone Company as manager of their exchanges at Burford, Brantford and St. George, resigned his position late in September and has returned to his old home in Cleveland.

Regulation of Sale and Installation of Electrical Heating Devices in Winnipeg

The city electrician of Winnipeg, Mr. F. A. Cambridge, one of the best known Canadian authorities on electrical inspection matters, has just presented his annual report for the fiscal year 1916-17. The report is interesting throughout but especially so in its reference to the "Regulation of Sale and Installation of Electrical Heating Devices, etc.," which is as follows:

Regulation of Sale and Installation of Electrical Heating Devices, etc.

"The increased use of electricity for cooking and heating also called for the inspection of 493 separate devices and their wiring installed for this purpose. The growing popularity of these devices is not without attendant difficulties, notably that of overloading of lighting circuits; the average individual is unfortunately seized with the idea that a lamp [illegible] so that [illegible] If citizens could but realize that the fuse is the safety valve designed for their protection they would likely refrain from allowing this practice—the evil is also very prevalent on motor installations, in fact the whole situation is for from satisfactory, and one calling for drastic treatment.

"Included in this branch of our work lies the examination of certain forms of electrical cooking and heating devices that are offered for sale by stores; in articles of American origin this is rarely necessary, for the reason that they are usually submitted to the Underwriters' Laboratories, Chicago, for criticism, but there are scores of devices manufactured in Canada—many in our own city that in absence of a Canadian laboratory we have to pass upon ourselves. This is a burden of responsibility we are not properly equipped to handle and entails expenditure of considerable time for which we have no monetary return. To give one instance—one type of electric heater formerly offered for sale in this city and subsequently condemned by us, necessitated the writing and perusal of no less than sixty-four letters and reports, together with examination of seven different devices before this line of appliances could be brought to a stage of sufficient safety to be handled by the public.

"A measure affording us considerable assistance was the step taken by the Legislative Committee in obtaining increased power from the legislature at its last session enabling us to condemn and order withdrawn from sale electrical apparatus deemed unsafe. Already under these powers several condemnations have taken place, and as a natural sequence dealers are more careful in placing orders. I am satisfied the advanced step will be the means of affording much needed protection to the public."

Under the heading "Fires and Accidents," the report gives some interesting examples of fires caused by defective electric wiring, reiterating at the same time the statement that electricity is frequently wrongly blamed for fires due to other causes. In this connection we quote again from the report:—

Fires and Accidents

"The Provincial Fire Commissioner and chief of Fire Department both called upon us to report on fires of alleged electrical origin. The frequency with which fires are blamed on electric wiring renders it highly desirable that the actual facts should be ascertained. In most of these cases no evidence open to us could be found to warrant a finding of electrical origin of fire; in eight cases, however, incipient fires were caused by electrical apparatus or wiring. Of these three were due to domestic electric irons being left with the current on and neglect to use approved stands; one was due to burnout of motor resulting from imperfect operation of an automatic switch; one from grounding of current in iron conduit system due to lack of testing by operating engineer in a private plant, and another due to water leaking over wires that were in proximity to metal ceiling. The only fire connected with theatres was an accident in a moving picture house operating room, in which, through carelessness of an operator, 2,000 feet of film was destroyed by fire; the protective features employed were sufficient to obviate danger to the audience. The remaining case was due to street lighting wires coming in contact with roof of building. The wires had been strung temporarily during a fire on adjoining street. The burning out of a couple of bell-ringing transformers in a large hotel building led to an investigation which showed that a number of these devices of sub-standard types have been installed without permits, in place of batteries that are the usual practice. While these transformers may be used with safety if of proper type, the use of defective types may be attended with danger to persons and property. With the co-operation of the building inspector, therefore, we propose checking up these devices so as to ascertain their condition.

"Several cases of electric shock were investigated, and causes, if found removed. In one case a tenant in a large apartment block received a 220 volt shock in a bathroom from a brass socket. This was in one of the older blocks wired prior to our present regulations. We secured the elimination of all reachable sockets in all the bathrooms of this block. In another case a janitor had undertaken to repair a switch and had left live contacts exposed in a bathroom, resulting in shock to party taking a bath. In another case amateurs had installed wiring in a stable in such a faulty manner that horses were severely shocked. A case where another amateur had installed an extension light for convenience of an invalid lady with the result that party was severely shocked by touching the metal of bedstead and imperfectly insulated lamp socket. These and other accidents as well as a large number of interferences with wiring, bringing about danger of fire and shock, illustrate the abso- who too often, are not only running considerable risk them- lute necessity of curbing the activities of unqualified persons, selves, but expose others to dangers that unfortunately are only manifest after someone has been more or less shocked."

Captain Basil Winter, M.C., electrical engineer, of St. John, N.B., reported missing, is now presumed to have been killed. News to this effect has been received by his mother. Captain Winter was a graduate of McGill University.

Winnipeg Jovians Resume Luncheons

The Winnipeg Jovian League have again resumed their bi-weekly luncheons, and from every indication they are in for a busy season. At a recent luncheon it was decided to hold a bowling tournament commencing on October 19th; and other features of the sports programme will be carried on throughout the season. The annual election of officers held on October 11th resulted as follows:—President, J. H. Schumacher; vice-president, W. G. Vogan; treasurer, C. T. Kummen. Executive Committee:—W. F. Minty, F. B. Kennedy, J. S. Henry, L. R. Baker.

The following recommendations were made, in connection with officers for the Jovian Order:—Cadmus, H. W. Billing; Statesman-At-Large, L. R. Baker; Statesman, A. E. Esling; First Tribune, J. S. Henry; Second Tribune, C. J Brown.

Companies Oppose Expense at This Time

Application has been made to the Quebec Public Utilities Commission, sitting in Montreal, to compel the Montreal Light, Heat and Power Company, Tramways Company, and Montreal Public Service Corporation to place their lighting wires underground in district No. 4 in the down-town district. The conduits have been constructed for the city by the Electrical Commission, who ordered the companies to bury the wires and remove the overhead equipment. It was stated at the hearing that the city had served several notices upon the companies without result, and the city now asked for a compelling order. The reply of the companies was that the high cost of labor and the impossibility of securing materials made it out of the question to do the work, and that therefore no such order as asked for by the city should be made. The hearing was adjourned.

Quebec Railway's Year

Quebec Railway, Light, Heat, and Power Company reports satisfactory expansion in gross revenues for the year ending June 30 last, but the rising costs of operation, affecting all utilities to-day, absorbed all the gain and a little more. Thus, while gross income at $2,062,882, including ordinary earnings and miscellaneous income, was nearly $100,000 ahead of 1915-16, net after operating expenses was about $32,000 behind. The surplus after interest was $200,587 against $215,403 the previous year, and the net sum added to surplus $121,670, bringing that account up to $684,572.

Figures for three years as to gross income, net income, and charges are given in the following table:

	1917.	1916.	1915.
Gross	$2,062,882	$1,968,604	$1,784,074
Expenses	1,155,969	1,029,750	924,817
Net	$906,913	$938,850	$859,257
Charges	706,326	723,447	739,482
Surplus	$200,587	$215,403	$119,775

Society for Electrical Development Aid in Christmas Gift Campaign

With a view to concerted action in selling electrical gifts, the Society for Electrical Development, 29 West 39th Street, New York, will conduct a nation-wide campaign which will take the place of "America's Electrical Week." Members and non-members of the Society will be offered attractively designed window lithographs, window cards, window transparencies, poster stamps, etc., without cost. The official design is now ready and embodies the Christmas spirit through picture story of the slogan "Give Something Electrical This Christmas." Suggestions are also available for advertising by newspaper, mailing cards, folders, etc.

Electric Railways

The War-time Bonus for Electric Railway Employees

The problem of meeting the railway employees' requests for higher wages is what is troubling the companies at the present time. Income is small and yet the cost of living is rising. War-time bonusing, already practised in England, Canada, and the United States, as a remedy to the situation, was discussed by E. G. Connette, president of the United Gas and Electric Corporation, New York City, at a meeting of the American Electric Railway Association held recently in New York. From his paper the following notes were taken:

From one end of the country to the other come the reports of the electric street railways whose employees are asking for relief to meet the high cost of living. The difficulties of the electric railways were brought, in part, to a critical state by world causes. While the great increase in the prices of commodities of all kinds and of labor began long before the war, it is in the period since the war opened that these increases have become the greatest.

The present situation all grows out of the mistake made in the days of street railway infancy, of setting a fixed fare, the nickel, to remain through all time to cling about the electric railway and choke it.

But the fact that the mistake of the fixed fare was made should not be allowed to hamper the future of our communities. For that, after all, is what insistence on a fixed fare would mean. Individuals come and go, and their fortunes are of little moment. But modern cities, to be prosperous, must have efficient public utilities. And without prosperity public utilities cannot be efficient. Anything done to the damage of the public utility damages the community by the harm it does to the public service.

Fixed Fare Involves Complications

This is the big lesson to communities of the struggle of the electric railways to get out of the web of a fixed fare. Whether the 6c fare is the remedy for present troubles, or the zone system or a new form of public control for electric railways, or whether it be municipal or near-municipal ownership need not be debated now. I am not inclined to find a panacea in any one of these measures.

One of the immediate problems coming in the train of perplexities brought on by the fixed fare is that of meeting the almost universal demand for more and more wages, and still more wages, caused by the rising costs of living due to the war. The company is rare, indeed, that has not made at least one raise in wages since say, 1912, and many of the companies have made several. Nor have they all been forced by strikes—numerous raises have come through direct negotiations with the men, through arbitration, and many have been made by the companies voluntarily, notwithstanding the fact that the earnings of very few, if any, of the companies warranted any increase in the cost of operation, especially if proper provision had been made for taking care of maintenance and renewals.

Meeting Wages Demands With Low Income

But as the tide of living costs continue to rise, and with it the need of higher wages, the same rising tide of costs finds the poor employers—and the interests of their employees as well—chained to the stake of the fixed nickel fare. The waters even now are rising about their necks, and some, indeed, have been utterly submerged, while others are in the hands of the life-saving crew—the receivers.

How can the demand for increase of wages or wage bonuses be met with income already too small? Some companies have endeavored to meet the emergency by a war-time bonus, holding, as seems true, that as the emergency is one of war time, it is too much to ask that a permanent wage scale be set now, that a war-time bonus, to endure only while war conditions last, is the fairer solution. Labor unions generally are opposed to a wage bonus of any kind, as the wage earner is naturally inclined to secure the highest possible wage in permanent form, and not one that cannot be automatically reduced. Therefore, the question of wage bonus is a difficult one to solve. The theory of it is doubtless correct from an economic point of view, provided the company can afford it.

England, Canada, and United States Offer War Bonuses

In England the Government Committee on Production decreed that all employees on the electric tramways more than 18 years of age should receive an increase of two shillings and six pence (about 60c) a week as a bonus on the war wage now being paid, while all employees under 18 are to get a bonus of one shilling and three pence (about 30c). These bonuses are regarded solely as war bonuses.

Numerous companies in Canada have announced war bonuses, in a desire to meet the increased cost of living.

In Vancouver, B.C., the men refused the bonus, but the arbitration board granted the increased wage demands of the men, stipulating, however, that the increase was only for the duration of the war, making it in effect a war bonus.

In the United States steps along this line, varying in details, have been taken, I am informed, by companies in Richmond, Joliet, Athens, Lexington, Topeka, Omaha, Louisville, Duluth, Cumberland, Harrisburg, Pa.; Los Angeles, Cal.; Seattle, Wash.; Washington, D.C.; Mobile, Ala.; Grand Rapids, Mich.; East St. Louis, Ill.; Colorado Springs, Colo.; Elmira, N.Y.; Chicago, and elsewhere. But the bonus is an emergency measure, the emergency brought about by the war. It is not a cure; it is a palliative. It does not remove the cause of the disease; it treats only the symptoms. Even if a company wishes to pay a war bonus, the great question still remains with most of them, "Where is the money to come from?" "Who is to pay the companies a war bonus."

Not one-half of the companies in the State of New York are making even their fixed charges; some are not making even their operating expenses.

Reduce Charges Against Railways

Electric railway men believe in the American policy of high wages and prosperous workmen, for this makes prosperous communities. But street car companies must pay the wages and their war bonuses out of the fares. Clearly, then, income must be more or charges against the railways, such as paving taxes, franchise taxes, etc., must be eliminated or reduced.

If indirect taxes, such as paving taxes, franchise taxes, percentage of gross income paid to cities, etc., were eliminated with urban companies generally, it would doubtless increase the income to such an extent as to preclude the necessity for raising fares, and, in some cases, would put the companies in a financial position where they would be able to provide for increase in wages or wage bonuses. It is believed that communities generally would prefer to have the indirect taxes removed from the public utility companies rather than have the rates raised.

Private capital has learned its lesson and has gone on a strike. It cannot be lured back to the electric railway field until it is granted full protection of its investment. Capital cannot be coerced—it must be convinced. It is certainly convinced at this time that the average street railway is in no condition financially to increase wages or grant war bonuses to employes, unless in some manner they are able to increase their income to meet the charge. The electric railway industry does not enjoy war profits. Its rates are fixed by law. The expenses of operating are constantly increasing by the increase in the price of labor and material, and the industry is not in a position to pay war bonuses.

Accidents Between Street Cars and Automobiles

At the meeting of the National Safety Council, Mr. C. B. Smith, Chicago, Ill., presented a report covering investigations of collisions between automobiles and electric railway cars. Over 19,000 accidents of nearly fifty electric railway companies had been investigated, and the data was collected in such a way as to determine the proportion of these due to the negligence of the automobile driver and that chargeable to the motorman. The investigation also served to bring out the circumstances characterizing the accident, together with the preventable causes involved. The report is to be considered as informational only, since the vastness of the field would require years to cover.

As a general classification the accidents were segregated under the following headings: Urban, suburban, interurban or country, and grade crossing. Along with the accident data themselves went statements as to the efforts being made by organizations to reduce accidents, and suggestions as to cooperation.

Arranging the accidents by geographical groups and weighting the numbers by multiplying by factors to take account of the population served by the several companies, it appears that the following figures represent the relative rates of accident occurrence: In the East, 13,874; in the Central district, 20,592; in the South, 18,602; in the Central West, 36,172, and on the Pacific Coast, 25,857.

Of preventable accidents the data showed that the causes in order of seriousness for the whole country were these: 1, automobile pulling onto track in front of car; 2, automobile operating at excessive speed; 3, insufficient clearance attributable to automobile driver; 4, miscellaneous; 5, other negligence of automobile driver; 6, inattentiveness of automobile driver; 7, automobile struck stopped car; 8, disobedience of traffic rules by automobile driver; 9, insufficient clearance chargeable to motorman; 10, defective or slippery pavement; 11, inattentiveness of motorman; 12, other negligence of motorman; 13, defective or slippery rail; 14, excessive speed of car; 15, defective equipment of automobile; 16, defective equipment of car; 17, view obstructed by snow, rain, or fog; 18, interference of passengers with motorman; 19, disobedience of traffic rules by motorman.

English Railways Find Fares Inadequate

Electric street railways in England, like those on this continent, are finding their present revenues inadequate and too low for best operation and service. The Mayor of Blackpool, at the annual meeting of the Municipal Tramways Association of Great Britain, stated that 16 tramways in the country were not able to make money and that 20 systems made a profit of no more than sixpence per hundred passengers. An upward revision of fares and restriction of class concessions seemed to be the only solution to the difficulty:

According to a paper on "Tramway Finance," the usual rate stipulated in the acts of Parliament is 1d. a mile, and in some cases this rate is in operation. How, then, could the revenue be increased By lowering the rates more riders might be attracted, but this could only be done by reducing the penny zone to a half-penny one—a course to which the authors were most strongly opposed—or by lengthening the zones. In either case a considerable increase in the number of passengers carried would have to take place before the previous revenue could be obtained, and local conditions must decide whether a sufficient increase would take place to ensure a larger revenue. The only alternative was to increase the rate per mile, which would require the sanction of Parliament. This question, it was said, was receiving the attention of the executive councils of the association and the Tramways and Light Railway's Association. Many undertakings which had been charging less than the statutory limit had increased their fares, with satisfactory results.

Low Workmen's Fares

The paper stated that workmen's fares were subject to a maximum of ½d. per mile, and undertakings which charged that rate could not increase the revenue from this source without statutory authority. Even where a profit was shown on the whole, it might be found that the early morning passengers were being carried at a loss, and the passengers paying the usual fares were contributing to make up this loss. Moreover, in some instances children's fares were on too liberal a scale. Many concessions had been granted to various sections of the communities, and these should be withdrawn.

On the subject of expenditures the authors said that much energy could be saved by careful driving and systematic inspection of electrical equipment of cars. Car meters, with careful examination of the records, were strongly recommended. Some system of standardization of wages, with a properly constituted authority to settle differences and disputes, was also deemed desirable. Furthermore, it was held that the utmost economy was necessary in maintenance and repairs, but that provision should be made to repair the permanent way in the near future.

In a paper on "Differentiation in Fares," the writer pointed out that tramways—at least, in London—were meeting with keen competition in respect to speed and fares, coupled with enormously increased expenses. Differentiation in fares in favor of bona fide workmen was compulsory, although it meant running at a loss, and such services were kept down to the minimum by the companies which first took up tramway work as a business enterprise. Municipalities, however, had increased them and reduced the fares, so that in London there was a continuous stream of workmen's cars between 3.30 and 8 a.m., and special cars between noon and 2 p.m., and again between 5 and 7 p.m., to cope with this traffic. A rate of 10 miles for 2d. (in one case 18 miles for 2d) seemed to be about the average. Temperate comment on this state of affairs, the author remarked, was difficult.

Too Much Differentiation

Moreover, many tramway systems allowed all passengers boarding cars before 8 a.m. to purchase return tickets at workmen's rates, which involved a loss to the undertakings. Other concessions had been granted to school children, blind people, etc., and the whole system of differential fares and free traveling was utterly wrong. The only true basis for fixing fares, it was asserted, is the cost of providing the service rendered, all who avail themselves of that service being required to pay on a uniform scale. All municipal tramway undertakings, therefore, ought to raise workmen's fares to the legal limit, cancel all free passes, and withdraw all special rates, or else have the municipality buy at full value tickets for the favored classes.

Sydney Electrical Engineer Visiting Canada

The electrical engineer in charge of the extensive municipal electric light and power department of the Municipal Council of the city of Sydney, contemplates leaving, four weeks hence, for Canada, with a view to the inspection of similar works and, possibly, placing considerable orders for electrical equipment with manufacturers in the Dominion. He will take forward with him letters of introduction furnished by the Canadian Trade Commissioner Serpice in Australia to interested manufacturers.

The City Council has already expended £2,500,000 on its electric light and power plant and, on account of the difficulty of obtaining machinery and other requisites, has notified that no further new installations or extensions will be permitted for some considerable time.—Weekly Bulletin, Dept. of Trade, Aug. 20.

Electric Vehicles Extensively Used in Postal Service

By A. Jackson Marshall

Electric trucks are being used very successfully by the Postal Department in a large number of cities. St. Louis has had a fleet of electric trucks in its postal service for more than six years, which have given splendid service even under the most severe weather conditions. These trucks are in service from 5.45 a.m. to 11.30 p.m. and average 30 miles each day.

The postal service in Boston uses 15 electric trucks which are operated on the "battery-service" plan. These "electrics" make runs of 25 miles each day, and have made substantial savings as well as greater efficiency in handling the mail.

Excellent in Congested Traffic

The largest electric postal fleet is probably that of the New York Postal Transfer Service, which operates 47 "electrics." These trucks have been in service for three years, and are on duty for two ten-hour periods each day. The dependable, simply-operated electric truck has been found almost indispensable in this service, which requires the speedy and safe negotiation of congested traffic.

It is interesting to note that several foreign countries have long appreciated the electric vehicle for postal service. A fleet of 30 electric trucks was installed in Vienna in 1913, and after one year's experimentation were pronounced to be particularly satisfactory for the transportation of the mails. This fleet has since been increased to 45 "electrics," and one truck has a record of 15 months postal service in Austria covering 500,000 kilometers with no interruptions for battery troubles or other repairs.

Recent reports from the Transvaal indicate that electric vehicles are used by the postal department of Johannesburg, and their economies in fuel and tire costs have done much to popularize the "electric" in this South African city.

Electric vehicles are also being used in considerable numbers for postal service in England, and have been successfully used in Berlin, Munich and Leipzig.

New Books

Electrical Machinery—by Terrell Croft; McGraw-Hill Book Company, New York, publishers; price $2.00; cloth bound; 8 x 5½; 317 pages; 302 illustrations. In the preparation of this book the author includes the essential and desirable things and omits what he considers the non-essential. He explains the theoretical principles and outlines the operating facts relating to a.c. and d.c. generators and motors and similar electrical machines on this basis. Considerable attention has been paid to control apparatus—installation and operation—and to trouble location—its correction, etc. Briefly, the work is a manual of explanation of basic theoretical principles, operation and management prepared particularly to assist the average man who is now, or who expects some time to be, engaged in practical electrical work. It is a most excellent book.

Electrical Measurements in Practice—by F. Malcolm Farmer, chief engineer, Electrical Testing Laboratories; McGraw-Hill Book Company, Inc., publishers; price $4.00 net; 350 pages, size 6 by 9 ins.; splendidly illustrated with photographs and diagrams; standard green cloth binding. In this volume the author has endeavored to present the subject of electrical measurements in a simple, practical manner, and from the standpoint of engineers actively engaged in making measurements, test and investigations in the electrical industry. All classes of measurements that the laboratory and testing engineer is called upon to make have been covered. Instruments are described in more or less detail, but minute descriptive matter pertaining to commercial instruments has been limited to those in most general use. Maximum demand meters have been more fully described because they are a comparatively recent development. A short chapter is devoted to curve drawing instruments.

Trade Publications

Induction Motors—Bulletin No. 180, by the Crocker-Wheeler Company, illustrating and describing Form Q induction Motor, 2 and 3 phase, squirrel cage type, 60 cycle, 1 to 300 horsepower.

C.G.E. Publications—Bulletin No. 49701, Drying and Filtering of Transformer Oil; Bulletin No. 48932, Arc Welding; Bulletin No. 42014, Headlights and Turbo-Generators for Steam Locomotives; Bulletin No. 46251-B, Outdoor Metering Outfits; Bulletin, Flood Lighting the National Capitol.

C.G.E. Publications—Bulletin No. 48700, Sprague electric monorail cranes; Bulletin No. 48923, Type W electric hoists, one to six tons; Bulletin No. 45505, induction voltage regulators (out-door type); Bulletin No. 46016, Thomson horizontal edgewise instruments for switchboard service; Bulletin No. 41801, motor-driven exhaust fan outfits; Bulletin No. 45606, choke coils for alternating current circuits; Bulletin 46030, portable instrument transformers.

Personals

Mr. Dwight Smith has been appointed Montreal district sales manager of the Northern Electric Company. Mr. Smith was formerly manager of the Ottawa branch office of the company.

Mr. G. Porter, chief engineer of the British Columbia Electric Railway Company, has severed his connection with that company and is entering business for himself. Mr. George Kidd, on behalf of the officials, presented Mr. Porter with a very handsome gilt French clock and wished him every success in his new venture.

The Dealer and Contractor

Toronto Electrical Contractors' Association Wants Large Attendance

The next dinner of the association is to be held at the Carls-Rite Hotel, Thursday, Nov. 1, at 7.30. As usual, the remainder of the evening will be spent in the discussion of the problems ever present to the Toronto contractors.

Thirty members were absent from the last dinner, but they were not allowed to forget that fact, for each delinquent member received the following personal letter:

"At the last dinner your chair was empty. After the effort to secure a full attendance, this was surely disappointing.

"It is so easy to let an association, such as ours, go to seed entirely on account of neglect and lack of interest on the part of its members. Neither you nor I want this to happen. Yet, to succeed, every man must get his shoulder to the wheel, because it is an uphill job at best.

"Before you throw this letter into the waste-paper basket please determine that you won't leave it to the other fellow next time."

This is bringing an encouraging response, and a much better attendance is promised for the coming meeting.

A special sign of activity is that, instead of mailing to the missing thirty their membership certificates, the secretary-treasurer, Mr. J. Everard Myers, is scurrying about, accompanying each certificate with a personal call. A thrifty official is the secretary-treasurer.

Contractors, whether members or not, should not miss this next meeting.

N. E. C. A. Broadens Its Scope—Aims to Make Contractor-Dealer a Vital Factor in Electrical Industry

The National Electrical Contractors' Association held its seventeenth annual convention at New Orleans, from October 9 to 13. The registration included contractors and representatives of other branches of the industry from every section of the United States. The main feature of the convention was the adoption of a new constitution and the change of name to "The National Association of Electrical Contractors and Dealers." The aim of these changes has been to broaden the scope of the association that it may include not only a much more representative membership of contractors and dealers whose principal business is electrical, but also make provision for an associate membership of persons, firms, or corporations who sell electrical supplies at retail as a department or minor part of their business. Radical changes in the new constitution, which was adopted without a dissenting vote, inaugurate a new era in the history of the electrical contracting business, inasmuch as it aims to evolve an association properly organized to establish the contractor-dealer as a vital factor in the electrical industry.

Scope of Association Broadened

The broadening of the scope of the association is evidenced by the following statement of its objects:

To promote the welfare of its members.

To distribute among them the fullest information obtainable in regard to all matters affecting the electrical contracting and retail electrical merchandising business.

To issue engineering and data sheets required in electrical contracting problems.

To collect data relating to the business of electrical contracting and retail merchandising.

To aid in bringing about more friendly relations between electrical contractors and electrical retail dealers, and others engaged in the electrical industry.

To assist in marketing high-grade electrical material and apparatus of American manufacture.

To encourage its members in establishing and conducting attractive retail electrical stores.

To elevate the standard of electrical installations.

To co-operate with the National Fire Protection Associawith with a view to improving the quality of electrical material, as well as its installation.

To co-operate with the American Institute of Electrical Engineers in the solution of all electrical engineering problems, particularly the preparation of and compliance with standard specifications.

To co-operate with the American Institute of Architects in recommending standard and improved electrical specifications.

To co-operate with all wholesalers of electrical supplies in the study of distribution, standardizing of packages and catalogue numbers, and in reducing the expense of wholesale electrical merchandising.

To co-operate with the National Electric Light Association, its members, and all other public service and municipal electric light and power companies in their endeavor to solve all problems tending to improve service to consumers.

To co-operate with the National Electrical Credit Association.

To collect and diffuse information affecting merchants, manufacturers, builders, and others engaged in erecting buildings.

Wider Membership

Under the new constitution, members in the association are defined as persons, firms, or corporations engaged in the business of electrical contracting and repairing, including the installation of electrical apparatus and materials, or engaged in the retailing of electrical supplies, or in both contracting and retailing, it being understood that such electrical contracting and retailing must be their principal business. Associate members are defined as those persons, firms, or corporations who sell electrical supplies at retail as a department or minor part of their business. For purposes of definition the electrical contractor or dealer shall be any individual, firm, or corporation carrying a general stock of electrical supplies, and who may be prepared to make electrical installations. He shall have an established location where he transacts his business with the public, and must have a sign or placard displayed announcing the character of his business, and shall maintain the usual set of books and records necessary to the conducting of any ordinary business. He shall carry a stock of electrical supplies of not less than $250 for the performance of electrical installation work.

Ills of the Industry

One of the features of the meeting was an address by Mr. William L. Goodwin, of San Francisco, on "The Ills of the Industry and Their Remedy." This address, abstracted in an article below, is perhaps the most comprehensive and instructive analysis ever made of the electrical industry. In it was included a plan known as the Goodwin plan, involving a campaign of education conducted principally through trade papers, trade organizations, and other channels, and co-ordinating the various interests in the electrical industry. The aim of this plan is to bring together into harmonious action the various interests in the industry, so that there may be established the retail distribution of electrical materials at a fair price to the consumer and at a fair profit to all parties taking part in the transaction.

Other addresses were delivered by S. E. Doane, chief engineer, National Lamp Works, Cleveland, O., on "Electrical Manufacturers of America as Compared With Those of Foreign Countries"; by W. J. Clark, of the General Electric Company, on "A Comparison of Manufacturing Conditions Abroad and in This Country"; by S. A. Chase, of the Westinghouse Electric and Manufacturing Company, entitled, "The Electrical Dealer from the Manufacturer's Standpoint"; by J. N. Shreve, of the Electric Cable Company, New York, on "Contractors' Obligations in War Time," and by J. M. Wakeman, of the Society for Electrical Development, on "The Relations of the Society Toward the Contractor-Dealer."

The Ills of the Electrical Industry

By William L Goodwin

One ill in our industry is the lack of definite known sales policies on the part of the manufacturer, the wholesaler, and the retailer. That condition, that lack of a definite policy on the part of the manufacturer, results in many misunderstandings, with consequent demoralization, wasted energy, and troubles to both parties. I recommend that each company summarize its own problems, define its policy, and make public announcement, so that we will know where each and every one stands, and we will then be in a position to make an intelligent decision as to the concerns we care to deal with and the products that we care to handle. Such well-defined policies are in common practice in almost every industry except the electrical industry.

Proper Merchandising Methods Needed

Another great ill in our industry is the lack of retail distribution. The basic causes leading up to a lack of retail distribution are many. Immediately they are understood and solved retail distribution will develop at a very rapid rate.

We have in the electrical industry a condition to deal with that is probably more serious than any other single item, in that the success of our whole industry depends upon proper merchandising methods. Electrical merchandising, at this time and in the past, has been in the control of men trained along technical and engineering lines—a profession which we are proud to recognize. But, on the other hand, I claim that scientific electrical merchandising is just as much a profession as electrical engineering. But to get men of an engineering trend of mind to appreciate that fact is our real difficulty because the master mind on engineering problems believes that he possesses a master mind on merchandising problems. Existing conditions should convince anyone that this is a fundamental error. What we need in this industry, and particularly in the larger companies, whether they be manufacturing, wholesaling, or central-station institutions, are men trained along merchandising lines, and that all questions pertaining to merchandising shall be handled by men of that special training rather than left to the will of engineers who do not understand the problem.

Have Proper Advertising

A member of this association, being asked whether or not he advertised, answered: "No; I have not not spent a nickel in advertising in ten years." Would you care to oblige Mr. Manufacturer or Mr. Wholesaler to drive his product through a retailer who has not spent a nickel in advertising in ten years We cannot keep such institutions or such people alive in the electrical industry. They must provide their own means of livelihood. We cannot establish any false barriers in the system of distribution.

Lack of known practices and principles produces another ill. We are suffering both from a lack of advertising policies and a lack of advertising, both in trade magazines and popular magazines. Hundreds of thousands of dollars have been wasted in our industry by poorly-prepared copy. If you are going to advertise—and you should advertise in some form or another—get the counsel and advice of men who understand advertising. You are preaching the gospel that if you want electrical work performed go to an electrical contractor. Then be consistent—if you want advertising go to an advertising man, because the greatest danger that we face is a poorly-prepared "ad" and an improperly-stated fact. In advertising you are dealing with the public. It is a means of passing the message from one to another. If you are going to indulge in it at all, get the experience of men who understand it.

Another ill: The tendency to discuss these questions within the confines of the various organizations behind closed doors. If there ever was an error in organized effort it has been that fundamental error in almost every form of American commercial organization. If our government really wants to provide constructive legislation then let us propose a bill that no commercial meeting shall ever be held unless it is open to the public. And I mean by the public, representatives of the press, of course.

Lack of Capital

Another great ill in our industry is the lack of a proper source for capital requirements. We have not in this country, so far as I know, financial institutions who have made a study of this branch of the electrical industry and are in a position to provide our capital requirements. In many other industries development is taken care of by surplus profits. But the electrical industry is going ahead at such a rapid rate that the accumulative profits, if devoted entirely to new capital requirements, would not represent more than 20 per cent. of our needs. Collectively we must provide an institution or institutions to take care of these capital requirements. This association should make a careful study, and should provide a budget of the capital requirements of the membership of the organization, and should lend its effort to supplying that capital to its membership. Other organizations should make a similar study and then, collectively, we should get together and, possibly, utilize the surplus of capital provided for any one branch of the industry in the others.

Another ill of the industry has been our tendency to mold public opinion in an unfavorable way, with ultimate detriment to the industry. How many electrical contractors, electrical wholesalers and artisans in our industry have said a kindly word for the public utility company in their community? Until a very short time ago, and possibly in some sections even at this time, the principal selling argument of the electrical contractor was to tell his trade of the miserable personnel and policy of the central station in his community.

No Statistics Applying to Electrical Industry

Another ill of our industry is the lack of statistics. There are practically no statistics compiled by our government on the electrical industry in a broad sense. We have statistics on the central-station branch of the industry and other statistics, probably of equal importance, but when it comes to statistics on the problems of electrical contracting and dealing you can get nowhere. We should immediately start out to gather these statistics that are so necessary. If the electrical manufacturers of this country could refer to statistics and there was presented to them the purchasing power of the electrical contractors and dealers of this country, you would at once command their recognition. They do not realize your importance, and you have very carefully, but foolishly, neglected to tell them so.

Do Not Think of the Price

One of the fundamental errors made by electrical contractors is their almost insane desire to purchase on price. Did any one ever hear of an electrical contractor purchasing anything without first qualifying, "What is your price?" That is the business of buying. Fundamentally it is wrong. When you buy you buy with an object in mind, and that object is to sell; and the object in selling is to produce a profit ,and that is what you are interested in. It is often said that a good buy is a good sell. Let us reverse it—a good sale is a good buy. Profit never results until the sale is completed. Be more considerate when you purchase of the possibility of selling at a profit, and be less concerned with the price at which you buy. When Mr. Salesman waits upon you and offers to sell you a product, give him this question and see whether he is going to sell or not: "How am I going to sell your commodity and what profit am I assured—reasonably assured—when I sell it?" A man or a concern who sells you on price, and price only, has no consideration for your interests. What we want in the electrical industry is constructive selling with the fundamental idea that the transaction from manufacturer or wholesaler to contractor does not complete the sale. The sale is not completed until the product is in the hands of the public; you have received your money, taken care of your overhead, and have something left for a profit.

Encroaching on the Functions of Others

Another fundamental error is the tendency of manufacturers and wholesalers and others to indulge in functions that could more economically be taken care of by others. I believe that if a careful study were made it would be shown there are very few wholesalers in the country to-day who are conducting a retail department at a profit. They apply the principles of wholesaling to the business of retailing. The expenses of retailing are charged to wholesaling, and vice versa. As a result of that condition, wholesalers are demanding from manufacturers margins far in excess of those they require to economically distribute the product of the manufacturer. I mean by that it is unfair to present to a manufacturer figures which show that your overhead is 17 per cent. and that you must have a compensation above that figure before you will be interested in marketing his product, when, as a matter of fact, your proper rate of per cent. should be 12, but it has been elevated to 17 because you have a retail department. If a wholesaler is going to retail, then let him segregate his business, just as he would segregate wholesaling and contracting; charge to retailing the proper items; and I want to tell you that no wholesaler in these United States to-day can indulge in retail electrical merchandising at any 17 per cent. overhead. But because he has consolidated wholesaling and retailing, he only obliges the manufacturer to concede him a discount equivalent to his overhead for wholesaling, plus a fair rate of profit, and in reality he retards the retailer who has an overhead of probably more than 25 per cent.

Standard Catalogue Numbers and Packages

Another ill of the industry is the lack of uniform catalogue numbers, standard packages, and packing methods. It is a great joy for a manufacturer to put out a standard line of goods and, with the narrowness that is usually displayed, attach his own private catalogue number; and so we have in the electrical industry to-day probably ten articles that could not be told apart by experts and they have ten catalogue numbers! Why, nobody seems to know. We have the same article put out by different manufacturers with varying standard package quantities, and so you must be an expert on catalogue numbers and catalogue quantities in order to buy the way you want to buy. To-day you order a hundred of a certain article and you get the standard package, and you go back and order a hundred of the same article from some other manufacturer and you find that his standard package is 250. Investigate any other industry, if you will, and compare the packing methods employed by other manufacturers with those used by electrical manufacturers.

We want the product packed in such a way that it will pass from manufacturer through the various branches to the retailer, and he will be enabled to place it upon his shelf, properly displayed, and not be obliged to rewrap when sent on to the consumer.

Another ill of our industry, and probably one of the most important of all, is the tendency of certain branches of our industry to engage in certain operations without profit. To be more specific, I mean that they engage in merchandising at less than the purchasing cost without regard to the overhead or profit, and then tack the loss onto another unknown, unvalued commodity, resulting in misunderstandaings, friction, and trouble, and eventually destructive regulation and legislation to the individuals participating in such practices.

The Cheap Price Fallacy

Another ill of the industry, and one that is not appreciated by electrical people, is that there exists a belief on the part of the contractor, wholesaler, manufacturer, and central-station interests that it is impossible to sell our commodity unless we offer it at a cheap price. And so the price of the electrical commodity has been lowered to such an extent that we haven't even left provision for actual overhead expense, and the various interests participating are unable to maintain their own institutions. I mean that it was the belief, which still obtains in many directions, that we would never interest the electrical public in household devices unless we could get the price of an electrical flatiron down to about $1.50. The result was no profit for wholesalers or retailers, a lack of desire on the part of the wholesaler or retailer to put any sales effort behind the commodity, resulting in the necessity of the central-station branch of the industry marketing this product because of the desire to fill their lines with kilowatts. Only recently we have found that, due to increases in cost of raw material, labor, and other causes, it has been necessary to increase the prices of all commodities. It has not retarded the sale of anything. We must never get the price so low that we will be obliged to reduce or remove the margins to those participating in the sale. The public will purchase our commodity when it is properly presented to them, and the question of price, whether it be $3.50 or $3.60, for an electrical flatiron, after all, is immaterial. We must appreciate the fundamental principle of selling and let the question of price take care of itself. This tendency extends to the contractors in an acute form.

Contractor Tries to Give Less Instead of More

What does the electrical contractor do? He gets the plans and specifications from the architect, and not in one case out of a thousand does he ever suggest an addition. But he immediately points out to Mr. Architect how much he can cut out of the job and save money. Your idea of merchandising is to give a man less than he actually wants and needs, and so our country is just littered with buildings of all kinds, in which it is almost impossible to connect an incandescent lamp, let alone a portable or an accessory of any kind, and in almost every case their elimination has been through the suggestion of the electrical contractor. The contractor should never bid on a job of any kind without offering some kind of a suggestion that it ought to be a little better or that something ought to be added. That is merchandising.

Another ill of the industry is the high percentage of labor cost in contracting work and also the highly competitive nature of the business. Until you, as electrical contractors, solve that problem you will never progress. You must develop your business so that at least 75 per cent. of it will be non-competitive, and if you are strictly an electrical contractor, depending upon building operations, you never can get into that class. You must attach to your contracts some sort of a maintenance clause so that once an installation is performed the customer will be a client of yours forever. When you make installations, industrial and otherwise, you should provide maintenance contracts, so that the electrician of the future in the industrial plant will be an employee of the electrical contractor.

Cost Knowledge and Accounting Methods Needed

Lack of knowledge of costs has been talked of so often and has been written of in the papers so much, but even so, as important as it is, it is not understood. Do not guess at your overhead. If you don't know, go out and hire an expert accountant to come in and tell you; and, if you cannot afford the services of an expert accountant, go to any jobber in the community and ask for the services of his head bookkeeper or credit man, and he will gladly come into your office and take off a statement and tell you what your overhead is. And then, after you know, remember that every operation must provide for the cost of material, labor, overhead, and profit.

Another great ill in our industry is the lack of standard accounting practices. The electrical manufacturers, the electrical wholesalers, and the electrical retailers, as groups, should operate under uniform accounting methods, because it is impossible to determine defects and losses except by comparison, and it is impossible to make comparisons to-day because each individual and concern has devised his or its own accounting method. We should have forms of accounting for electrical contractors, based on the volume of the respective businesses, but whether the business be one of $1,000,000 a year or one of only $10,000 a year, the accounting systems should be so standardized that comparisons could readily be made.

Specifications and Overtime Work

Preparation of specifications on the part of electrical contractors is another ill in the industry that must be remedied. That is a function that properly belongs to the consulting electrical engineer, and so long as you perform the function of another you may expect retaliation, and you are certainly meeting with it from many directions to-day.

The question of compensation for labor charges in overtime work results in many disputes between the owner and the contractor. They should be clearly defined and provided for in your initial contract, so that overtime and extra work will not be a question of bargaining when the day of settlement arrives.

Another ill is the lack of proper legisaltion. If there is any industry in this country that should be regulated by state license it is that of the electrical contractor. We are suffering from lack of legislation and licensing because in the past the contractors have attempted to have inaugurated various rules or adopted various laws for the purpose of fencing in the industry, as it were, advocating high licenses and other means of restraint. What we want in every state in this country is a license law that provides for an examination by a competent body, even though the license fee may be as low as $1. We should proceed immediately along an educational propaganda with that idea in mind. Let us encourage legislation to that extent, but make the fee nominal.

Lack of standard contract forms is, indeed, an evil that too often comes home to the electrical contractor. I know of cases where electrical contractors have submitted bids on specifications when they were not permitted to retain the specifications or the plans until the bids were opened, when it was found that other pages and other clauses had been injected into the plans and specifications, and they have signed their contract without checking back, and have been obliged to perform work that was never figured in the initial contract. We need standard forms of contracts that will protect the electrical contractors as well as the owner. Read any of the existing forms in current use and they are all designed to protect the owner without regard to the interest of the contractor.

Navy League's Work Described to Montreal Electric Club

The objects and work of the United States Navy League were outlined by Mr. Prescott W. Robinson, the representative of the league in Canada, at the Montreal Electrical luncheon on October 24. Mr. E. N. Hyde presided. The league, said Mr. Robinson, had several hundred thousand members in the United States, as well as members in Canada, Great Britain, and France. Its purpose was to create a second power fleet, the motto being "Efficiency." The league had vigorously fought bills detrimental to the United States navy. It acted in co-operation with the Navy League of Great Britain, both having aims in common. The activities of the United States Navy League were divided into three classes—recruiting, recreations, and comforts. Over 75 per cent. of the recruits from the Middle West had, since the war, joined the navy as the result of the efforts of the league. Recreation meant efficiency, in that the league took measures to ensure the mental and physical welfare of the men, thus maintaining a standard of efficiency. The league had also supplied over half a million of knitted articles to the men, and over 40,000 articles to the British, Russian, and French fleets. Mr. Robinson spoke of the work done in realtion to the Red Cross, and also referred to the opposition met with from Americans in Canada—a class of men whom he strongly criticized. The weather conditions in the North Sea he described as exceedingly bad, and such as called for the need of every comfort in the way of knitted goods that could be sent. The only reason why Canadian and United States cities had not been bombarded was the existence of the Grand fleets. Mr. Robinson spoke of the work done in relation to States present, and appealed for subscriptions to the Liberty Loan. He also gave figures showing the enormous growth of the United States army and navy, and concluded by quoting examples of the co-operation in past days of the British and United States navies.

Popular Lecture on Home Lighting

The second of the series of illustrated popular lectures is now ready for distribution. This lecture answers the question "How shall I light my home?" Some forty-five lantern slides accompany the lecture, which covers in detail and in an authoritative manner the specific requirements for home lighting installations, combining the scientific, artistic and psychological principles, but stating these requirements in a non-technical paper of interest to popular audiences. The paper covers some twenty pages of reading matter and paragraphs descriptive of the various lantern slides.

The applications of the fundamentals of home illumination are taken up: First, with respect to the color, quality, intensity and direction of the light from the illuminant. The correct applications of daylight illumination are also considered. Second, the necessary equipments for porches, hallways, reception rooms, libraries, dining rooms, bedrooms, parlors, closets, bathrooms, kitchens, basements, laundries, etc., are described and illustrated. Considerable space is given to the functions peculiar to each part of the home and details of the corresponding illumination requirements are decribed. Third, the fixtures and glassware suitable for home use are covered in paragraphs dealing with diffusion, reflection, absorption, and decorative characteristics of available types. Descriptive lantern slides illustrate these characteristics. This lecture, and the popular lecture on Store Lighting, maintains a neutral position as regards artificial lighting by electricity or gas.

This lecture, with accompanying lantern slides, may be secured for presentation upon application to the general offices of the Illuminating Engineering Society, 29 West 39th Street, New York, N.Y. Reservations should be made considerably in advance of the dates of presentation, as only a few sets of the lecture are available at this time. A small service charge covering the cost of up-keep and delivery is made for this lecture, and for a similarly prepared lecture on "Store Lighting."

Helping the Telephone User

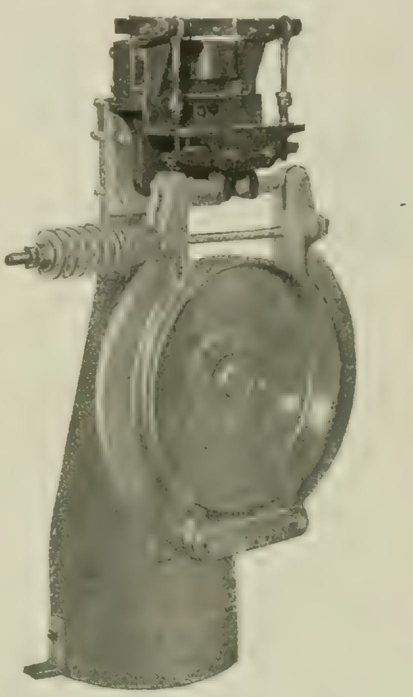
In the C. P. R. ticket office, St. James Street, Montreal, two display windows of special interest to telephone users were recently shown. They were designed to help along the campaign for a better, more intelligent use of the telephone by the everyday user. The subscriber's telephone equipment was exhibited and explained in detail by means of cards, and such necessary practices as first consulting the directory before calling a number, speaking distinctly, directly into the telephone, answering promptly and courteously were attractively suggested. In the centre of one window an indicator registered the number of telephone calls passing through the Main exchange at the instant. An exact model of the first telephone was on view, together with pictures which told much of the history of telephone progress down to the present day.

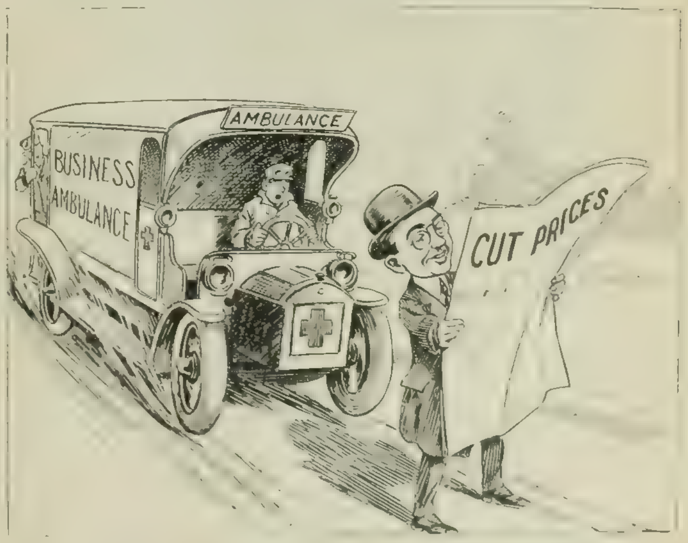
Westinghouse Elevator Brake Magnet

In general, elevators operating on alternating current are entirely dependent upon a friction braking mechanism for obtaining smooth and accurate stops. Failure of the brake may result in injury to passengers and damage to property. Such failure may be successfully guarded against by equipping the brake with a magnet. To meet such requirements, the Westinghouse Electric & Manufacturing Company, of East Pittsburgh, Pa., is marketing the brake magnet shown, which assures safe, positive and quiet action of the brake. All chatter and magnetic hum have been eliminated and immersion in oil is unnecessary.

This magnet, which is known as the type E, is designed for use with the parts regularly furnished by the elevator builder, and may be used for elevator motors operating on 220, 440 and 550 volt, 25 to 60 cycle, two and three phase circuits. The complete magnet is compact, durable, and very light, weighing only 70 pounds. It is installed by mounting directly over the brake wheel, the base being bolted against the machined gear case. The operation of the magnet is as follows:—

When no current is flowing through the motor, the brakes are set, being held by a spring. When the motor is started, a portion of the current passes through the shunt magnet coils, energizing them, pulling down the brake armature. The travel of this armature, which is about ¼ inch at the point farthest from the bearing, gives a horizontal motion of 1/16 inch to each of the lower ends of the bell-cranks, compressing the springs and releasing the brake. When the current fails or is cut off, the armature is released and the brake applied by the springs. The recoil of the magnet armature is taken up by buffer springs, which may be adjusted to the proper compression. The pull of the magnet is 150 pounds on the lower ends of each of the bell-cranks, making a total of 300 pounds compression available.

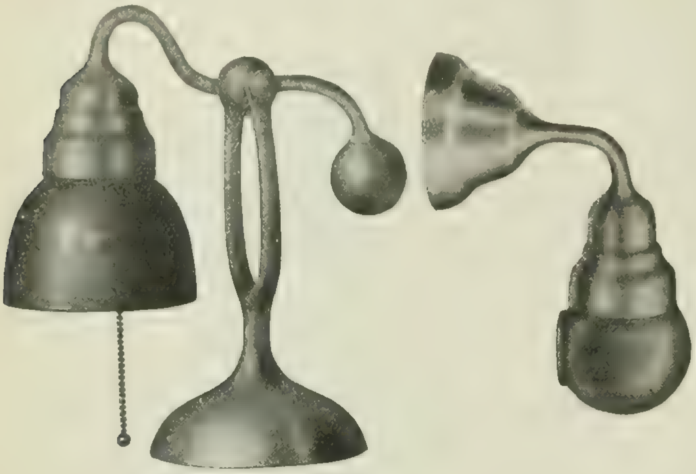




Courtesy National Electrical Contractor.
Something "coming" to him.

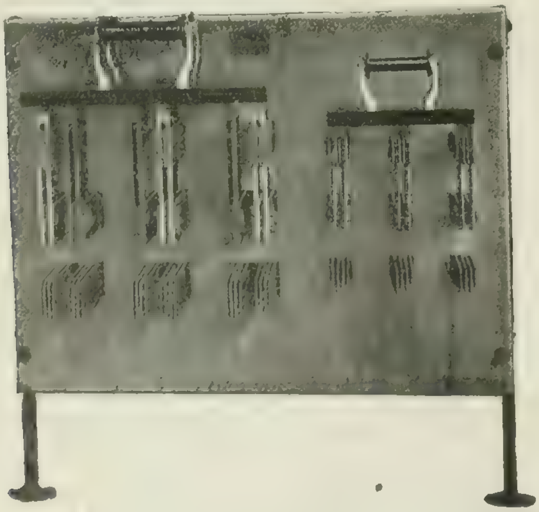
Hospital Fixtures

The Pettingell Andrews Company, of Boston, Mass., have issued an attractive bulletin, entitled "The 'Dee-Cee' Hospital Lighting Fixture." These fixtures are seamless, dustless, and scientifically constructed throughout. The catalogue is splendidly illustrated and, by comparative drawings illustrates the advantages of the new fixture over the old types that were used in the recent past and are still used by hospitals that are not quite up to date or have failed to value at its true worth the importance of illumination which is at the same time ample, efficient and sanitary. The perfection of the unit manufactured by this company may be judged from the illustrations in the catalogue, two of which are reproduced herewith. These fixtures are manufactured in great variety to fill every requirement of the modern hospital.



Split Lever Starting Switch Throws with Reduced Effort

The Canadian General Electric Company offers an ingenious arrangement to reduce the effort necessary to operate large lever switches used for starting large synchronous converters from the a.c. side in conjunction with auto-transformers. This is made clear from the accompanying illustration, which shows two triple pole lever switches for starting a six phase converter. The switch on the left really consists of two switches, side by side, which act as a single switch when closed in the lower position. There are two cross bars with separate handles, one-half of the blade of each pole being fastened to one of the cross bars, while the other half is attached to the other cross bar. When used to start a synchronous converter the upper contacts are connected to the two-thirds voltage tap for but a short time and the contacts are constructed to make contact with the portion of the blades first thrown downward or to the running side. This portion of the entire switch comprising half the blade area, carries the current until the remaining half of the switch can be thrown to the lower position. Switches of this type have been built up to 5,000 amperes capacity. They are easily operated and avoid the alternative which is the installation of large solenoid-operated circuit breakers at considerably more expense.



James Fulton Cummings, pioneer electrical engineer, born in London, Ont., 48 years ago, died recently at Long Beach, N.Y. Mr. Cummings installed the first electric light stations in Philadelphia, Cincinnati and a number of other cities. For many years past he had been associated with interests controlled by Thomas A. Edison.

The Dominion Battery Company, Limited, being formed by Mr. Wm. M. Turnley, formerly with the Canadian Carbon Company, will manufacture a full line of batteries, flashlights and accessories. Their factory will be located at 736 Dundas Street East, Toronto, and orders are now being taken for delivery after November 15.

One of Tallman Brass and Metal Company's candelabra designs.

To Maintain Industrial Activity

Subscribe Liberally for

Canada's Victory Bonds

If for no other reason than that of self interest, it is of the utmost importance to every manufacturer and merchant that the fourth War Loan of the Dominion of Canada (to be known as Canada's Victory Loan and to be offered in November) be fully subscribed.

The further extension of credits to our Allies is imperative if Canada's manufacturers wish them to continue buying here. And there can be no question about that, because upon their purchases will depend our industrial and agricultural prosperity.

Then, too, the money subscribed will be spent in Canada.

The money must come from our entire people, but a good lead from manufacturers and merchants is absolutely essential and will encourage the multitude of smaller investors. The bonds are an excellent investment. Money is not tied up in them, because they are readily saleable and because of their value as collateral.

Apart from all business and financial reasons, however, the great fact remains that Canada must have more money to carry on her part in the war.

Every ounce of our financial, as well as fighting strength, is needed.

Great Britain *must* now purchase where she can get credit. If Canada grants the credit---she will get the business.

Issued by Canada's Victory Loan Committee
in co-operation with the Minister of Finance
of the Dominion of Canada.

Current News and Notes

Brantford, Ont.

Wednesday, October 24, was the occasion of an event which will be memorable in the history of the city. His Excellency the Duke of Devonshire unveiled the memorial erected to Professor Alexander Graham Bell, commemorative of his invention of the telephone at Brantford forty-one years ago.

The operating statement of the Brantford Hydro-Electric System, just issued, indicates a surplus of $2,013.26 for the month of September. The revenue up to September 30 amounted to $79,518.48, and the expenditures to $60,287.06, leaving a surplus of $19,231.42. The total surplus of 1916 was $15,441.03, and the total surplus up to August 31, 1917, was $32,659.19.

Brantford Township, Ont.

The first pole of the new Hydro-electric system in Brantford Township was recently hoisted, with due ceremony. The route has been laid out, and it is expected that it will be completed before the snow flies.

Charlottetown, P.E.I.

At a recent meeting of the City Council notification was received from the Light and Power Company that, owing to the heavy increase in the price of coal, they were obliged to increase the rates for domestic lighting to 15c per 1,000 watts, with the usual discount. This meant an additional revenue only of from $3,500 to $4,000, and only was equal to half the increased cost of coal. When conditions became normal a readjustment of the rates would be considered. There was no increase in the rate for electric power.

Edmonton, Alta.

Extensions are being planned by the Edmonton Electric Department which will provide service to fifty or more prospective consumers in the outlying districts.

Galt, Ont.

Commissioner George E. Fisher of the Galt Hydro-Electric Commission is advocating the formation of a public utilities commission in Galt, Ont., to administer the hydro, waterworks, and parks. A by-law will likely be submitted in January.

Goderich, Ont.

An electric fire alarm system is being installed in Goderich, Ont.

Guelph, Ont.

The Light and Heat Commission are purchasing two more light and power transformers at a cost of $10,000. The order goes to the Canadian General Electric Co., through the Hydro-electric Commission.

Haileybury, Ont.

The Temiskaming Telephone Company, which has been operating without a franchise since last spring, are now seeking to renew their franchise. They propose, as an inducement, lowering the long distance calls from Cobalt and New Liskeard from 25 cents to 15 cents, in addition to paying a 3 per cent royalty and the cost of submitting a by law to the ratepayers.

Hamilton, Ont.

The power shortage was the subject of discussion at a recent meeting of the Hydro-Electric Commission. Reference has been made to the statement of Sir Adam Beck, that Canada was not receiving her due proportion of power from the Niagara River development, and that, while Canada is entitled, under treaty, to more than half of the energy developed, the ratio being 36 to 20, the United States at the present time is getting the larger share. The Dominion Government, it was said, is the only medium through which an adjustment can be made.

Kingston, Ont.

Hydro-electric power for Kingston, Ont., is promised for the latter part of November.

Moncton, N.B.

The Moncton Tramways, Electric, and Gas Company recently submitted to the City Council a statement of earnings for the quarter ending Sept. 30, 1917, as follows: Electric, $10,806.31; gas, $24,535.49; total, $35,341.80.

New Toronto, Ont.

At a recent meeting the New Toronto Power and Water Commission approved the proposal of the Hydro-electric Commission to change the system of distribution so that the township and New Toronto should have separate sub-stations. The town's consulting engineers, James, Loudon and Hertzberg, recommend the purchase of an electric centrifugal pump for the new incinerator and the running of a power line to the plant. The cost of the line is estimated at about $140, and this may be borne jointly by New Toronto and Mimico.

New Westminster, B.C.

The city council of New Westminster has closed a contract with the Western Canada Power Company for a supply of power and light at the Poplar Island shipyard.

Ojibway, Ont.

The Essex Terminal Railway Company, Walkerville, Ont., are extending their electric line from Ojibway to Amherstburg, Ont.

Peterboro, Ont.

The Utilities Commission have decided to abolish all the direct current arc lamps and install incandescent service instead. As soon as they can be procured, the following new incandescent lamps are to be installed; three lights on Dufferin Street; two lights on Romaine Street; one light corner of Bolivar and John Streets; one light corner Perry and Lock Streets; three lights on Aberdeen Ave.

Sarnia, Ont.

In order to cover the costs of extensions made necessary by the increase in the business of the department, the council have decided to grant $35,000 to the local hydro-electric commission. This money will be raised at once, it is proposed, by an overdraft on the bank, and will later be covered by the issue of debentures.

Trade Note

Mr. Irving Smith, of Montreal, advises that owing to increase in other lines, he is giving up the representation for Messrs. R. E. T. Pringle, Limited, in that district. Mr. Smith has a number of splendid agencies, including Dossert & Company, New York; Campbell Electric Company, Lynn, Mass.; Bridgeport Metal Goods Mfg. Company, Bridgeport, Conn.; Electric Fuseguard Company, Newark, N.J., and Lindsley Bros. Company, cedar poles, Nelson, B.C.

Electrical News
Generation, Transmission and Application of Electricity

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Orders for advertising should reach the office of publication not later than the 5th and 20th of the month. Changes in advertisements will be made whenever desired, without cost to the advertiser.

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The "Electrical News" will be mailed to subscribers in Canada and Great Britain, post free, for $2.00 per annum. United States and foreign, $2.50. Remit by currency, registered letter, or postal order payable to Hugh C. MacLean, Limited.

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Vol. 26 **Toronto, November 15, 1917** **No. 22**

Acute Power Situation in Ontario

The power situation has reached such a stage in the Province of Ontario that it has been suggested that a system of evening daylight saving be put into force by requiring that offices and stores be closed at the hour when the peak begins to come on; this would probably be around 4.30 o'clock during November and December. In Toronto a very considerable relief has been obtained by withholding the street lighting until the peak is over, but the big objection to this course is that the lights are off at the time the streets are the most congested and there is greatest danger of accidents. If, then, the bulk of the people could be got home before the darkness sets in it would not only set back the office, store, and street railway peak load by an hour or an hour and a half, but it would ensure reasonably light traffic a little later in the evening, during the time it is necessary to withhold street lighting.

The situation will doubtless be rendered all the more complex as a result of the large munition orders that are reported to be coming from the United States, especially if these orders may be looked upon as placing us under an obligation to that country. If we could recall from the United States all the power which rightly belongs to Canada and which by agreement, is returnable "on demand," we should have ample for all immediate needs. This is not an altogether easy matter, however, as Canada hesitates to interfere with vested interests and especially if the power is being used in part for munition work—unless there is absolutely no other way out of the difficulty. It has been rumored on the street that those who are responsible for the procuring of this munition order are now opposed to interference with the present Niagara Falls power situation, the inference being that their opposition to the recall of Canada's power is one of the conditions of obtaining the contract. If there is any truth in these rumors, it would appear that the big order is a two-edged sword, in that while it creates a largely increased demand for power, it automatically makes it more difficult than ever to get that power. In the meantime the situation is described by those in control as "acute," and it is every citizen's duty to do whatever lies in his power, however small that may be, to give relief.

Best Investment Ever Offered to Canadians

There are many reasons why every reader of the Electrical News should subscribe for the present government bond issue and use his influence that others may do the same. Loyalty and duty hold a prominent place; also the desire for a profitable investment; also the unsurpassed security behind it. But all these aside, the unanswerable argument still remains that the success of the loan means a continuance of "good business."

Suppose, for example, you have a sum of money, say $1,000, saved from your business, which you intend to set aside, as a reserve, in some interest-bearing investment. You may buy a bank stock, a bond issue of some city or town anywhere in Canada, a railway, telephone, telegraph, or public utility stock. You do not know or question where the principal goes; you ask only that the dividend be secure.

Suppose, in contrast to this, that a client or corporation of unquestioned wealth and dependability came to you and offered to borrow your $1,000, pay the same rate of interest, and, in addition, turn round immediately and spend the whole amount in your business so that you would also reap your usual business profit. What a very much better proposition it would be! The attractiveness of such an investment would be perhaps twice as great, to you, as the bank stock or the municipal bond.

Now this, in effect, is what the Canadian Government undertakes to do. The money is not to be used on some big Dominion work that profits only a few, but is to be spent for supplies—raw and manufactured—taken from all over Canada —country and city and town alike. And as all true Canadians are engaged in "supplying" something, practically every man, woman, and child profits as this money becomes gradually redistributed.

Thus a subscription to the coming loan is a business proposition of the most attractive kind. Anyone who profits by "good business" in Canada—and who does not?—will be considering his own interests twice over when he invests in a bond—first, in the excellent interest return, and, second, in the trading profit from so much extra turnover.

A.I.E.E. Visit Toronto Harbor Work

Instead of "electric night" at the Engineers' Club, Friday, October 26, was "electric day" on the bay. The occasion was the tour of the new harbor developments, undertaken by the Toronto section of the American Institute of Electrical Engineers. This tour was very popular—so much so that it was necessary, unfortunately, to turn down some of the later applicants, the three fast and commodious motor launches of the Harbor Commission being fully crowded. The trip embraced a survey of the water-front east from Yonge Street to the new Don River diversion channel, where a landing was made. Walking up the new trestle structure of the street railway extension just being constructed by the commission, an excellent view was obtained of the extent of the reclamation work east towards the Coatsworth Cut and west, where factories and warehouses are gradually clustering on the reclaimed area, and where a few years ago the solitary duck-shooter or naturalist was the only sign of civilization. Most notable among these factories at present is, of course, that of the British Forgings plant, which extends from Cherry Street east to the Don roadway. Side by side with this, the world's greatest electric steel plant, it is hoped the near future may see the erection of a steel plate and sheet mill, sufficient at least to take care of Canada's growing shipbuilding industry. The development of the industrial district at the east end of the bay is proceeding fast. Ships are being constructed along the eastern shore; the four hundred-foot ship channel, with its turning basin at the foot of Carlaw Avenue, is visibly taking shape, and the concrete marginal ways and streets are nearing completion.

From the eastern channel the cruise was routed through the lagoon, which, in view of the reclamation work completed at Ward's, Sunfish, and Muggs' Islands, now extends practically the whole length of the group known as Toronto Island from east to west. The last portion of the tour was made through the broken water, which the easternly breeze was piling up around the western channel, making impossible a landing to inspect the new water-front, with its slips extending from Bathurst to John Streets.

BUY A VICTORY BOND AND KEEP BUSINESS BOOMING.

A report of this trip would be incomplete without some tribute to the unequalled courtesy of Mr. Wainwright and his colleagues of the Harbor Commission. It is not too much to say that their unfailing kindness makes a harbor tour quite different from any other inspection trip of this kind.

A Dominion Power Controller

Following representations that had been made to the Dominion Government regarding the shortage of hydro-electric power in Ontario, as outlined in our last issue, the office of Dominion power controller has been created, and Sir Henry Drayton has been appointed to the office. Sir Henry immediately set to work investigating the situation, and has held conferences with a committee of the Municipal Hydro-Electric Association of the province and others. The statement was made that, owing to franchise limitations, certain of the generating plants were not operating to capacity, to which the controller replied that. irrespective of all considerations, every bit of power should be made available for the emergency. An order has since been issued to this effect.

Certain representatives of the hydro municipalities urged a curtailment of the export of power now going to the United States, but it was pointed out by Sir Henry that New York State was also short of power for munition work, and that any curtailment there would mean a loss to the allied cause, just as a shortage here. He urged that there should be the heartiest co-operation between municipalities and companies on both sides of the border line, that the common cause may be furthered in every possible way.

Chicago Diverting Nearly Twice Authorized Amount of Water from the St. Lawrence System

Closely allied with the power shortage at Niagara, as well as of all water power of the St. Lawrence, is the question of water diversion through the Chicago Sanitary Canal. One feature which has perhaps not been sufficiently emphasized in connection with this scheme has been forcibly [illegible] [illegible] recently published [illegible] respecting the power plant, which evidently is a very important feature of the project. The figures show that the disposal of sewage is only a secondary consideration when compared with the financial aspect of the hydro-electric power development. This is further accentuated by the fact that the estimated profits from the extensions now under construction would be about 100 per cent. Figures showing the growth of the power plant give the development as 15,278 h.p., with earnings of $130,936 for the year 1908, while, in 1915, these figures had reached 55,640 h.p. and $932,566 respectively. Although the authorized diversion is but 4,167 cubic feet per second, it is notorious that about 8,000 cubic feet per second is actually flowing through the Chicago River.—Eight Annual Report, Commission of Conservation.

Advisory Council Opposes Export

The Advisory Council for Scientific and Industrial Research has forwarded to the Minister of Public Works a resolution opposing the development of hydro-electric power at Coteau Rapids, on the St. Lawrence River, for export purposes. It is pointed out that when power is exported to a foreign country, vested interests, if not vested rights, are created, which make it extremely difficult to recover the power at a later date, without causing international complitions. The council recommends that regulations be enacted that no more Canadian power be exported, but that this be all retained as a national asset for the development of industries in our own country.

Report re Lake of the Woods Levels

An interesting report has just been made to the International Joint Commission relating to official reference re Lake of the Woods levels. This report is in four separate volumes, and is submitted by the consulting engineers, Arthur V. White and Adolph F. Meyer. The volumes consist of (a) a text of 314 pages, with numerous illustrations; (b) a bound volume of 144 plates; (c) a volume of tables, including meteorological data on the Lake of the Woods watershed, water levels, discharge tables, miscellaneous tables, etc., and (d) a watershed map of the Lake of the Woods, mounted on cloth and bound in book form. All four volumes are bound in the regular blue cloth binding of the department.

The International Joint Commission is composed of three members from Canada and three from the United States, with a secretary for each group. The Canadian members are: C. A. Magrath, chairman; H. A. Powell, K.C., and P. B. Mignault, K.C.; Lawrence J. Burpee, secretary. The United States members are: Obadiah Gardner, chairman; James A. Tawney and R. B. Glenn; Whitehead Kluttz, secretary.

5-YEAR VICTORY BONDS YIELD 5.81 PER CENT.

Matter Will Be Carefully Considered

The Dominion Government has replied to the representatives of the Commission of Conservation regarding the generation of power at Couteau Rapids, and has given the assurance that no decision will be reached until every body or individual in Canada desirous of making representations in the matter shall have had a chance to be heard.

The Board of Railway Commissioners have handed down a ruling in connection with a request to force the North Lancashire exchange of the Bell Telephone Company to install a telephone for a party located more than 200 feet from the telephone lines that the board finds itself without power to issue the order asked for.

Water Powers of Canada Demonstrated by Moving Pictures in Montreal

Moving pictures of the water-powers of Canada and of many of the principal central stations were shown at the Canadian Society of Civil Engineers, Montreal, on November 8. The pictures were loaned through the courtesy of Mr. J. B. Challies, superintendent of the Water Powers Branch, Department of the Interior, who also prepared a brief statement, which was read to the members. The pictures covered the whole of Canada with the exception of Ontario and the Maritime Provinces, and showed how rich Canada is in the way of water-powers. Brief data of the history, power developed, and also of the possibilities of the powers was given. Besides the actual falls, there were pictures of the power-houses (exterior and interior), machinery, transmission lines, receiving stations, maps, lakes, mountains, and also of the principal streets of Montreal, Winnipeg, Calgary, Vancouver, and New Westminster.

In view of the important developments in Quebec Province many pictures dealt with powers and stations there. These covered Chambly, Lachine Rapids, Soulanges, Cedars Rapids, Shawinigan Falls, St. Timothee, and Grand'Mere. Two pictures of plants on the Winnipeg River, Manitoba, were screened—that of the Winnipeg Electric Railway Company and that of Winnipeg City. There are six undeveloped powers on the river under government control—the Great Slave and the Upper and Lower Seven Sisters' Falls, Du Bonnet, Pine Falls, and others. On the Bow River, Alberta, the Horseshoe Falls and the Kananaskis Falls are developed by the Calgary Power Company, in addition to the Minnewanka storage dam. Further west the British Columbia Electric Railway have developments at Schyler Falls and at Lake Buntzen, while the Western Canada Power Company have a power at Stave River. The pictures of the British Columbia section illustrated lumber mills electrically operated and also the various uses to which electricity can be applied on the farm.

10-YEAR VICTORY BONDS YIELD 5.68 PER CENT.

Pictures Were Urgently Desired

The statement by Mr. Challies was as follows:

Prior to and shortly after the commencement of the war the Canadian Government received many requests from influential educative, financial, and commercial organizations in the United States for motion picture films covering the natural resources of Canada. A particularly urgent request was made for films showing the water-power situation in the Dominion, and the government instructed the Dominion Water-Power Branch to undertake the preparation of suitable scenarios. It was found very difficult to develop a scenario of a semi-popular nature which would at the same time be sufficiently technical to interest the technologist. Furthermore, it was exceedingly difficult to evolve scenarios showing in a comprehensive way the water-power situation in the Dominion without incorporating an undue amount of statistics and text. It was finally decided that the most satisfactory method would be to show in a semi-popular way the water situation developed and undeveloped continguous to several of the more important commercial cities of the Dominion, including Montreal, Toronto, Winnipeg, Calgary, and Vancouver.

Under the immediate direction of Mr. B. E. Norrish, A.M.C.S.C.E., an engineer of the Dominion Water-Power Branch, the motion picture operators and their assistants were set to work in the fall of 1916. Owing to climatic conditions, it was found very difficult to secure in certain cases wholly satisfactory pictures, and some of the field work had to be repeated. The general results were, however, fairly satisfactory. During the winter of 1916-17 the several thousand feet of film was assembled, arranged, and titled, and after trial screenings the scenarios, as they now appear, were finally decided upon. The cost of these films was shared by the Departments of the Interior and Trade and Commerce. Through the foreign trade commissioners of the latter department they are now being screened throughout the world wherever war conditions will permit.

To Be Shown in Theatres

It is probable that these films will be so arranged that they will be suitable to be shown in the various circuits and motion picture theatres in Canada and the United States. It is considered that the net result to Canada will be not only the harnessing of general public interest in Canada and the United States to our water-power resources, but the attraction of capital to the development of new water-powers and the location of new industries to use power now developed.

It is interesting to note that a few days ago one complete set of the films was despatched to London, England, at the special request of a member of the Inventions Board of the Admiralty, to be shown to high government and scientific officials, probably in collection with the solution of some war problems with special reference to the fixation of nitrogen.

The screening to date of these films before important groups of bankers, stock exchanges, boards of trade, educative institutions, and government officials throughout the United States has already resulted in a tremendous increase of active interest in the water-power situation in the Dominion.

In the administration and investigation by governmental organizations of our water-power resources, in the art of development and use of our water-powers, and in their adaptation for industrial requirements, to municipal use, and to the comfort of the home, there is a history of which Canadian engineers and members of the Canadian Society of Civil Engineers have every right to be proud. It is, therefore, appropriate that these films be screened before the members of the Canadian Society of Civil Engineers.

Next Meeting A.I.E.E. Toronto Section

The next meeting of the Toronto section of the A.I.E.E. will be held on Friday, November 16, 1917, at the Engineers' Club, 96 King Street West, beginning promptly at 8 p.m. A series of three papers will be read and discussed, as follows: "A Commercial Method of Taking the Ratio of Current Transformers," by Harry S. Baker, Ontario Power Company; "Demand Meters," by Perry A. Borden, Hydro-Electric Power Commission; "Relays," by C. W. Baker, Canadian Westinghouse Company.

Nearly 1,000,000 horse-power of hydro-electric energy is utilized in Europe in the production of nitrogen—the mightiest weapon in both war and peace. Canada has many millions of horse-power running to waste, but none is used in the production of nitrogen.

The Electric Club of Toronto

At its weekly luncheon on November 9 the Electric Club of Toronto heard an interesting talk by Mr. Arthur Hawkes on "Relations Between Ontario and Quebec." At the next luncheon of the club, November 16 Mr. Joseph E. Atkinson, president of the Star Publishing Company, will address the members, his subject being "After the War—Industrial Changes."

Electric Presents for Christmas Giving

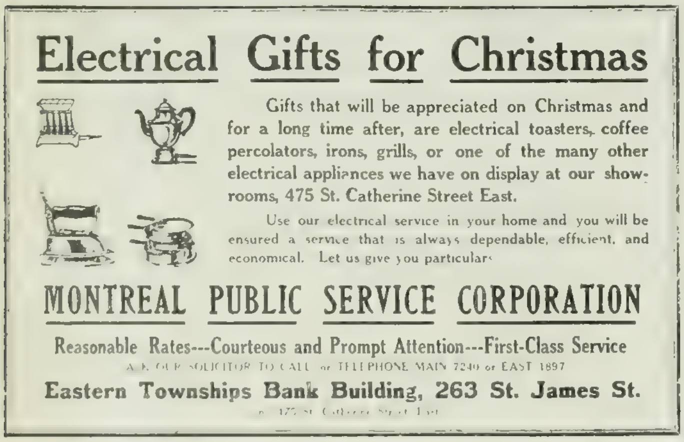
The Public Mind is Ripe for a Campaign on "Useful" Gifts and Will Respond, as Never Before, to Publicity—Prepare Your Line Of Action Without Delay

Give Something Electrical i. e. Useful.

It has been variously estimated that the actual cash expenditure in Canada for Christmas presents each year is between two and twenty million dollars. Probably it is about midway between the two figures. When one considers the universal recognition of the custom of giving gifts at this season many of them very expensive—it is surely not far wide of the mark to place the amount at a dollar a head, or, roughly, let us say, at eight millions.

Now, the question that every manufacturer, jobber, central station, dealer and contractor should be asking himself as the Christmas season approaches is: What part of this eight million dollars is coming to me?

At first thought it may appear that eight million dollars is a large sum of money to spend in this way, at a time, too, when economy is the watchword of every business and home, and one may feel inclined to discourage such an expenditure. Christmas gift-giving is a custom that is permanently established, however, and it is doubtful if any influence, except actual absence of funds, could be brought to bear to exert any appreciable effect on its extent. As a matter of fact, it is not the actual amount of money spent to which one takes objection; it is rather the feeling that a very large percentage of this money is spent unwisely. Presents are chosen without due regard for the actual value they represent and without sufficient consideration of their fitness for the needs of the person who receives them. Indeed, until a few years ago, it was considered almost a reflection on the dignity of a friend to give anything except as a "reminder." This tradition is dying, but it is by no means dead. It is simply because we have not shaken ourselves free of this same tradition that we hesitate at the thought of eight million dollars in Christmas presents.



Electrical Gifts for Christmas

Gifts that will be appreciated on Christmas and for a long time after, are electrical toasters, coffee percolators, irons, grills, or one of the many other electrical appliances we have on display at our showrooms, 475 St. Catherine Street East.

Use our electrical service in your home and you will be ensured a service that is always dependable, efficient, and economical. Let us give you particulars

MONTREAL PUBLIC SERVICE CORPORATION

Reasonable Rates---Courteous and Prompt Attention---First-Class Service

ASK OUR SOLICITOR TO CALL or TELEPHONE MAIN 7240 or EAST 1897

Eastern Townships Bank Building, 263 St. James St.

or 475 St. Catherine Street East

The big Public Service Corporation in Montreal does a tremendous Christmas trade

Probably nothing has done more than the electrical business to kill this old tradition of giving "mementos," "reminders," and "whatnots." The first thing about an electrical gift is that it's just as much a memento as the old-fashioned "memento" ever was—that's one reason for its growing popularity. The second thing is its fitness for practically any age and any condition in life. The idea behind a gift ought to be greater joy in life, and the best test one can possibly apply to a contemplated gift is: Will it make life more pleasant, the long, tiresome days a little shorter, the dark days a little brighter, the heavy burdens a little lighter, the sum total of the joys of life a little bit greater? The gift that will do this is surely the ideal gift for Christmas or any other time.

What shall I give in war time?

Something Useful of course—therefore something Electrical from the

HYDRO SHOP

everything of the best—everything at cost

- Tea Pots
- Ovenettes
- Toy Trains
- Fans. Irons
- Toy Stoves
- Vibrators
- Curling Tongs
- Shaving Mugs
- Water Kettles
- Water Heaters
- Chafing Dishes
- Sewing Machine & Other Motors
- Travelling Irons
- Christmas Tree Lamp Outfits
- Heaters, Toasters
- Heaters for Autos
- Vacuum Sweepers
- Coffee Percolators
- Washing Machines

Choose NOW while the choice is good

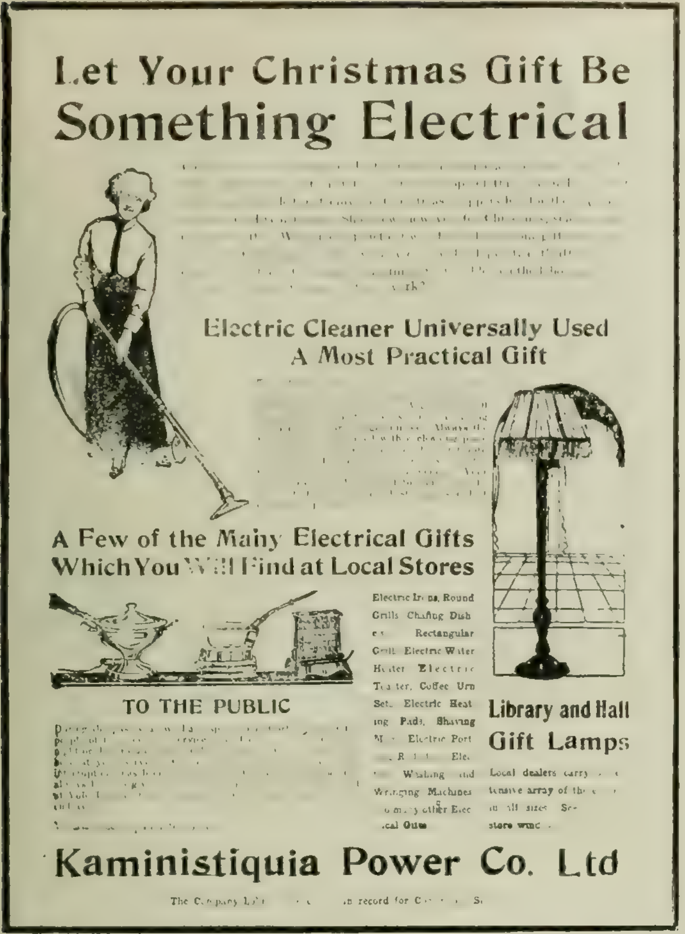
Toronto Hydro Shop

226 Yonge Street Phone Ad. 2120

Toronto Hydro urges something useful, that is, something electrical

Now, to the electrical man it appears, of course, that **everybody knows** that electrical appliances of one kind or another fulfil most nearly the ideal of the Christmas gift. But **does** everybody know? Perhaps at one time or another everybody has been **told,** but we do forget so many things, and especially if the telling did not convince us. Even the man or woman who has said, "Yes, I'll buy electrical stuff next Christmas," gets side-tracked by some other more aggressive merchant and buys something else, simply because the other product is brought to his attention at the psychological moment. The fact to remember is, however, that there is no prejudice against electrical goods; no argument that cannot be successfully met; no competition that cannot be overcome if the electric trade is **alert.**

What the electrical business needs is **publicity.** If our products had only one-half or one-third of the excellent qualities they actually possess they would probably have been advertised two or three times as much and be used more uni-



Let Your Christmas Gift Be Something Electrical

[illegible]

Electric Cleaner Universally Used A Most Practical Gift

[illegible]

A Few of the Many Electrical Gifts Which You Will Find at Local Stores

Electric Irons, Round Grills, Chafing Dishes, Rectangular Grill, Electric Water Heater, Electric Toaster, Coffee Urn Set, Electric Heating Pads, Shaving M[illegible] Electric Port[illegible] [illegible] Elec[illegible] Washing and Wringing Machines [illegible] many other Elec[illegible] [illegible]cal Out[illegible]

Library and Hall Gift Lamps

Local dealers carry [illegible]tensive array of th[illegible] in all sizes. Se[illegible] store wind[illegible]

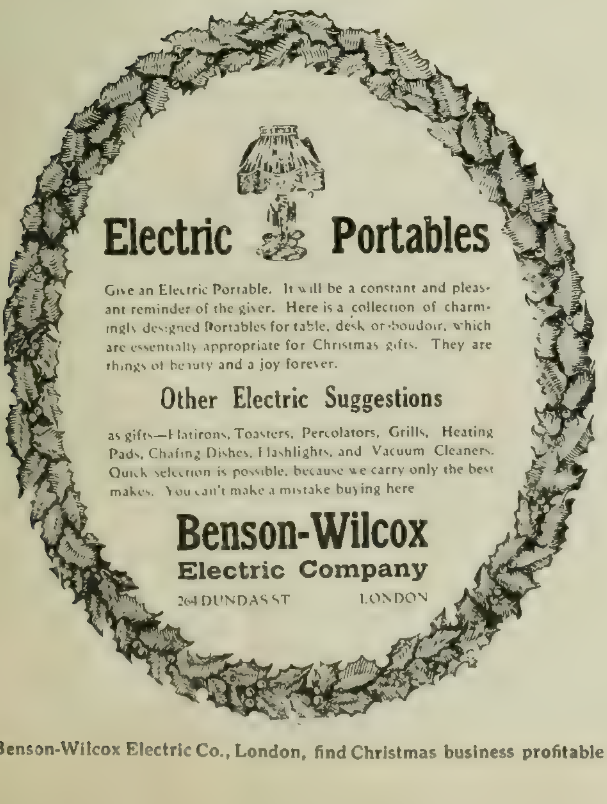
TO THE PUBLIC

[illegible]

Kaministiquia Power Co. Ltd

The Company [illegible] record for [illegible]

The Kaministiquia Power Co. is educating the Fort William public



Electric Portables

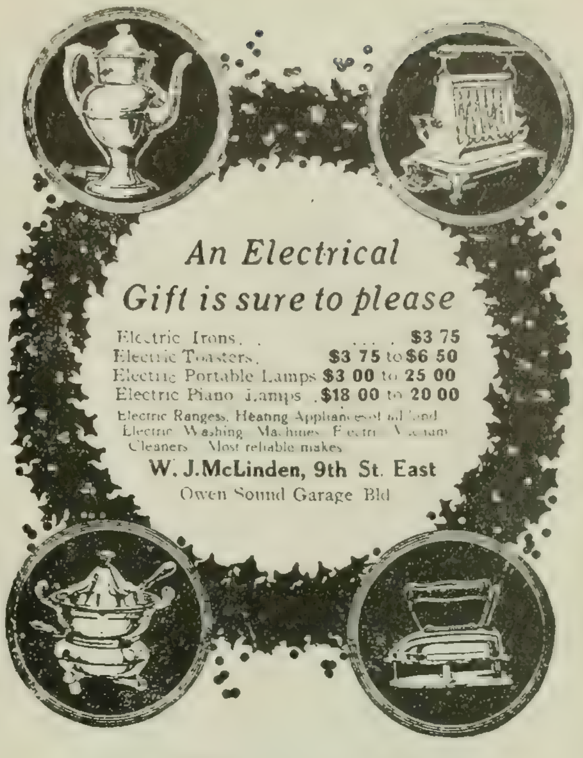
Give an Electric Portable. It will be a constant and pleasant reminder of the giver. Here is a collection of charmingly designed Portables for table, desk or boudoir, which are essentially appropriate for Christmas gifts. They are things of beauty and a joy forever.

Other Electric Suggestions

as gifts—Flatirons, Toasters, Percolators, Grills, Heating Pads, Chafing Dishes, Flashlights, and Vacuum Cleaners. Quick selection is possible, because we carry only the best makes. You can't make a mistake buying here

Benson-Wilcox
Electric Company
264 DUNDAS ST LONDON

Benson-Wilcox Electric Co., London, find Christmas business profitable



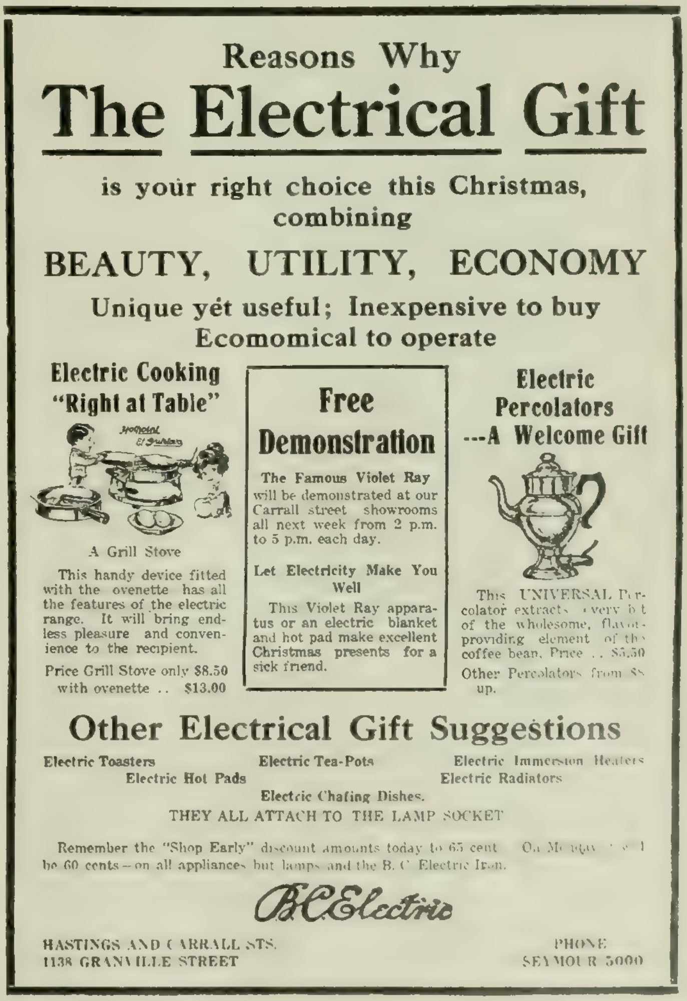
An Electrical Gift is sure to please

Electric Irons.	$3 75
Electric Toasters.	$3 75 to $6 50
Electric Portable Lamps	$3 00 to 25 00
Electric Piano Lamps .	$18 00 to 20 00

Electric Ranges, Heating Appliances[illegible] and Electric Washing Machines, Electric Vacuum Cleaners. Most reliable makes

W. J. McLinden, 9th St. East
Owen Sound Garage Bld

Prominent dealer in Owen Sound does his bit



Reasons Why

The Electrical Gift

is your right choice this Christmas, combining

BEAUTY, UTILITY, ECONOMY

Unique yet useful; Inexpensive to buy
Ecomomical to operate

Electric Cooking "Right at Table"

A Grill Stove

This handy device fitted with the ovenette has all the features of the electric range. It will bring endless pleasure and convenience to the recipient.

Price Grill Stove only $8.50
with ovenette .. $13.00

Free Demonstration

The Famous Violet Ray will be demonstrated at our Carrall street showrooms all next week from 2 p.m. to 5 p.m. each day.

Let Electricity Make You Well

This Violet Ray apparatus or an electric blanket and hot pad make excellent Christmas presents for a sick friend.

Electric Percolators ---A Welcome Gift

This UNIVERSAL Percolator extracts every bit of the wholesome, flavor-providing element of the coffee bean. Price .. $5.50

Other Percolators from $8 up.

Other Electrical Gift Suggestions

Electric Toasters **Electric Tea-Pots** **Electric Immersion Heaters**
Electric Hot Pads **Electric Radiators**
Electric Chafing Dishes.

THEY ALL ATTACH TO THE LAMP SOCKET

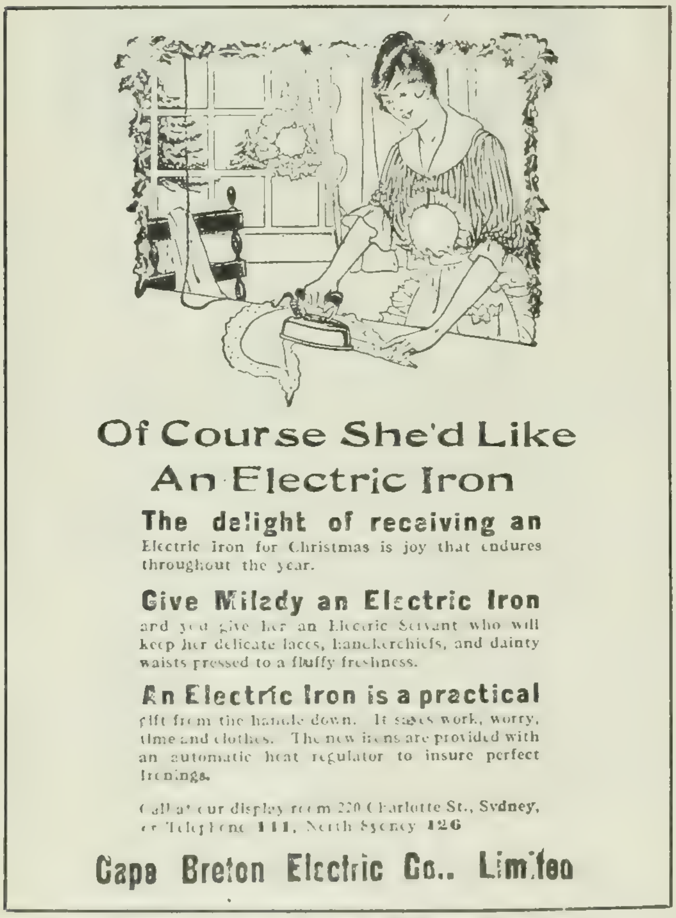
Remember the "Shop Early" discount amounts today to 65 cent[illegible] On Monday [illegible] be 60 cents—on all appliances but lamps and the B. C. Electric Iron.

B.C.Electric

HASTINGS AND CARRALL STS. PHONE
1138 GRANVILLE STREET SEYMOUR 5000

Cities on the Pacific Coast appreciate Beauty, Utility and Economy of electrics versally than they are to-day. Confident in the attractive qualities of our goods, we have neglected to sound their praises. As a result, electrical devices and appliances with legion possibilities for giving pleasure and reducing labor in our homes still take second or third place to gifts of an entirely inferior rating, whether sentimental, artistic, or utilitarian. How much longer is this condition going to exist—a condition so easy to remedy?

The solution of the remedy is **more publicity**—that's all. **Tell** the people; tell them **often, truthfully, forcefully.** Let us get away from the idea that quality will sell our wares, and that, having the quality, it is unnecessary to advertise them. The people don't know how good our wares are unless we tell them. They naturally think, indeed, that if electrical goods are not advertised widely it is simply because there are so few points in their favor. The public is used to advertising, expects it, and, indeed, as many daily examples are evidence, will buy an inferior article that is widely advertised in preference to a better article that has been less talked about. This is no reason, however, why a good article does not need publicity; if advertising sells poor goods it will be all the more effective where quality is present to supplement the advertising.


Of Course She'd Like An Electric Iron

The delight of receiving an Electric Iron for Christmas is joy that endures throughout the year.

Give Milady an Electric Iron and you give her an Electric Servant who will keep her delicate laces, handkerchiefs, and dainty waists pressed to a fluffy freshness.

An Electric Iron is a practical gift from the handle down. It saves work, worry, time and clothes. The new irons are provided with an automatic heat regulator to insure perfect ironings.

Call at our display room 220 Charlotte St., Sydney, or Telephone 111, North Sydney 126

Cape Breton Electric Co., Limited

Of course she'd like an electric iron—or anything else electric

The foregoing argument, then, appears to have established two facts: First, that the Christmas business is big enough to make it worth while; and, second, that it can't be had without going after it. These conclusions, too, are borne out by the action, this year, of the big electric publicity organization in the United States—The Society for Electrical Development. Their two previous publicity campaigns—in 1915, Electrical Prosperity Week, and, in 1916, America's Electrical Week—were tremendous successes, and gained a world-wide reputation. This year they have considered that the most fruitful field for their activities is in the Christmas trade, and have just launched a big campaign, to be known as America's Electrical Christmas.

It is a pity, perhaps, that we in Canada have no central organization with a driving force akin to that of the Society for Electrical Development, but, lacking this incentive, the necessity for each individual member of the trade to take his share in a publicity campaign for the coming season is all the more urgent. Now is the time to plan our window displays; our demonstrations, whether in the window, the store, or possibly in the home; our advertising, newspaper, letter, moving picture. Lay all your plans **now,** so as to have time to look them over once or twice, revise them if necessary, and make sure that they have the power to "pull."

MAKE IT AN ELECTRICAL CHRISTMAS

Any gift that you buy in our Electrical Shop will be most appreciated this year because it will be useful all year round. Look over this list:

Toaster Stoves.
Coffee Percolators.
Electric Irons.
Reading Lamps.
McClary "Hydro" Ranges.
Electric Washing Machines.
Vacuum Cleaners.

BENNINGTON & YOUNG
103 ONTARIO STREET.

In Stratford, Ont.—Useful all the year round

Last Christmas was the first year in which any noticeable attempt was made by retailers in electrical goods in Canada to advertise them into the homes as Christmas presents. According to many reports, the results were very gratifying. This year, however, should see a further vast increase in holiday business. The public is in a recipient mood for the argument to "give something **useful.**" Let us make the most of the opportunity, safe in the assurance that, while benefiting the trade in general and the individual trader in

The Gift Electrical

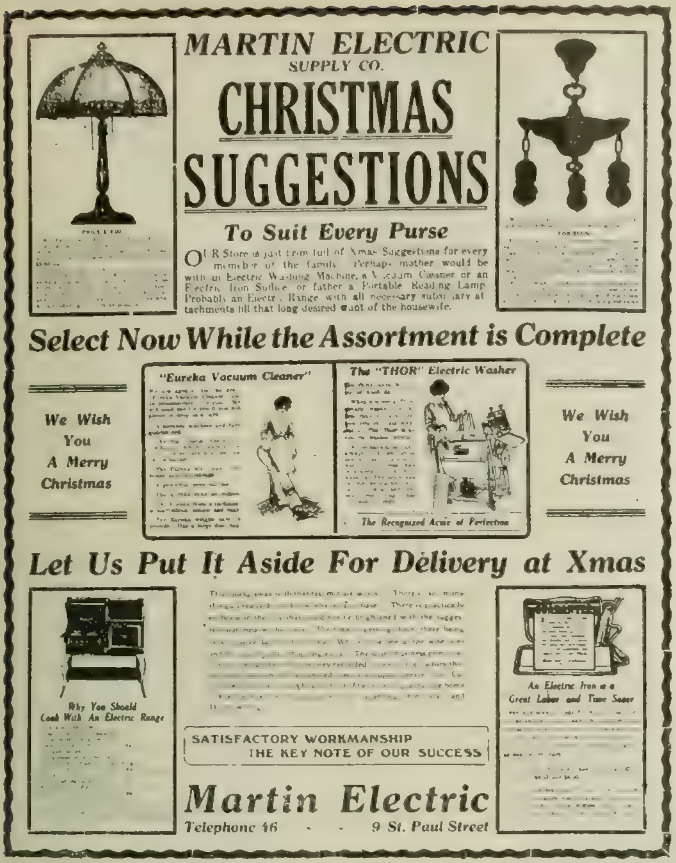
affords real and lasting pleasure to the fortunate recipient. The giver is gratefully remembered every day in the year.

Call in and see our display of suitable Electrical Gifts. You will find "just the thing" here.

Any purchase held for Christmas delivery if desired.

The Ottawa Electric Co.
35 SPARKS STREET TEL. QUEEN 5000

Remembered every day in the year in Ottawa



MARTIN ELECTRIC
SUPPLY CO.
CHRISTMAS SUGGESTIONS
To Suit Every Purse

OUR Store is just brim full of Xmas Suggestions for every member of the family. Perhaps mother would be with an Electric Washing Machine, a Vacuum Cleaner or an Electric Iron Suffice or father a Portable Reading Lamp. Probably an Electric Range with all necessary subsidiary attachments fill that long desired want of the housewife.

Select Now While the Assortment is Complete

"Eureka Vacuum Cleaner"

The "THOR" Electric Washer

The Recognized Acme of Perfection

We Wish You A Merry Christmas

Let Us Put It Aside For Delivery at Xmas

Why You Should Cook With An Electric Range

An Electric Iron is a Great Labor and Time Saver

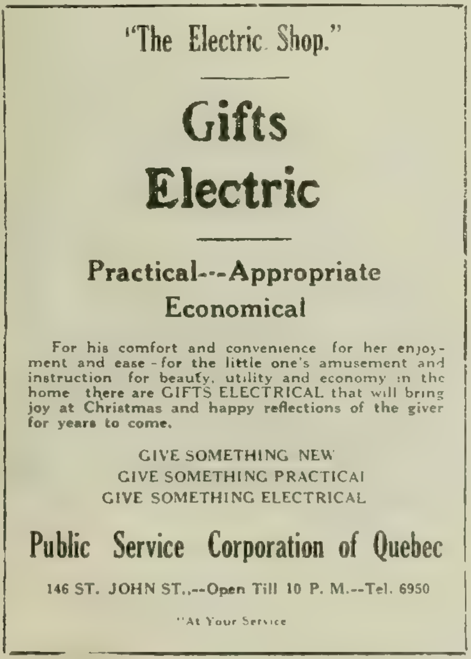
SATISFACTORY WORKMANSHIP
THE KEY NOTE OF OUR SUCCESS

Martin Electric
Telephone 46 - - 9 St. Paul Street

The Martin Electric had faith to the extent of full page advertisements.

particular, the public will also receive such value for their money as can scarcely be duplicated elsewhere—a fact they will appreciate more fully day by day through the whole year nineteen eighteen.

The illustrations reproduced herewith are typical of many which appeared in local newspapers during the month of December, 1916, and, as will be noted, are fairly representative of the various provinces. These advertisements are not necessarily models of perfection, but in the main they are along the right line. Some of them show signs of haste in preparation; some lack "punch," perhaps, and some were not so well printed in the original as they might have been; it is well that the advertiser should insist on a fairly high standard with his local paper, as otherwise the value of his advertisement is discounted. Taken as a whole, however, they represent that the retail electrical industry is off to a good start. May the coming holiday season see it make and consolidate still further advances. Lay your plans **now.**



"The Electric Shop."

Gifts
Electric

Practical---Appropriate
Economical

For his comfort and convenience for her enjoyment and ease - for the little one's amusement and instruction for beauty, utility and economy in the home there are GIFTS ELECTRICAL that will bring joy at Christmas and happy reflections of the giver for years to come.

GIVE SOMETHING NEW
GIVE SOMETHING PRACTICAL
GIVE SOMETHING ELECTRICAL

Public Service Corporation of Quebec
146 ST. JOHN ST.,--Open Till 10 P. M.--Tel. 6950
"At Your Service

The Electrical Gift, in Quebec, is practical, appropriate, economical

Montreal Electric Lunch Club

In the absence of Chief Tremblay, of the Montreal Fire Department, who was unable to attend at the last moment, Mr. E. N. Hyde, of the Northern Electric Company, was the speaker at the Montreal electrical luncheon on November 7. Mr. Hyde spoke on some aspects of light. He said that one of the most significant characteristics was its velocity, and it was thought by some that as the velocity of light and electricity was similar, electricity and light were more closely allied than was known. Mr. Hyde also referred to the minute size of wave lengths of light, the use of the microscope, telescope, and spectroscope, and, finally, to glare in relation to lighting and its effect upon the eye. He warned them against the dangers of the nitrogen lamp in this respect. Manufacturers were, of course, desirous of obtaining the greatest efficiency, and to this end wanted high intensity, which was liable to injure the eye. While striving to get this intensity, it should not be done at the cost of injuring the eye. There were plenty of good glassware which would give good results without causing injury to the eye.

20-YEAR VICTORY BONDS YIELD
5.61 PER CENT.

The following are the speakers provisionally arranged for by the Papers Committee of the Montreal Electrical Luncheon: November 28, Mr. C. W. Trenholme, Navy League of Canada, Montreal; December 5, Mr. J. A. Ewing, K.C., Montreal; December 12, Mr. L. McMahon, Bell Telephone Company, Montreal; Capt. MacKeen, vocational department, Military Hospitals Commission, Montreal; January 9, Sir H. Ames, Montreal; January 16, Mr. A. T. Marin, Montreal Light, Heat, and Power Company; January 22, Dr. Hadley, Montreal.

Established Channel of Business Information

Last week Governor Whitman of New York State broke several engagements and travelled all the way to Chicago to address the Associated Business Papers of the United States and Canada. He said he did so because he regarded the business press as the established channel of business information, and, as New York State is the largest business and financial centre of the world, he desired to place the views of New York before the business interests of the United States. The business press of Canada has been quietly performing great work for Canadian manufacturers, business men, and financiers since the war broke out.

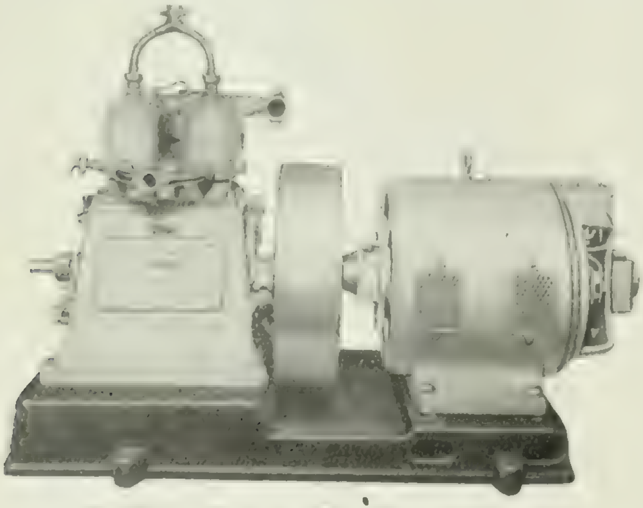
Lend to Your Country—
—All Canada is Your Security

Electrical Equipment of New Connaught Laboratories

The Connaught Laboratories of the Department of Hygiene of the University of Toronto were formally opened by His Excellency the Duke of Devonshire on October 25. This event marks an important step forward in the movement for the scientific prevention of disease in this country. The laboratories are the gift of Col. Albert Gooderham, a member of the Canadian Red Cross Society, and they were named, with the consent of the ex-Governor-General, the Duke of Connaught. Sir William Hearst, who was present at the opening ceremony, expressed, on behalf of the Ontario Government, their thanks to Colonel and Mrs. Gooderham for their generosity and stated that at the next session of the legislature a bill would be introduced appropriating $75,000 for the work, thus increasing the present endowment to $100,000.

Exterior Connaught Laboratories

The new institution is the only one of its kind in Canada, and perhaps, indeed, it may be said to stand alone among enterprises of a similar nature on this continent, as those on the other side of the line are largely commercial undertakings manufacturing the laboratory products for profitable sale. The University of Toronto laboratory, on the other hand, is making its output available at cost, we understand, and solely in the interests of better health and as a patriotic measure.



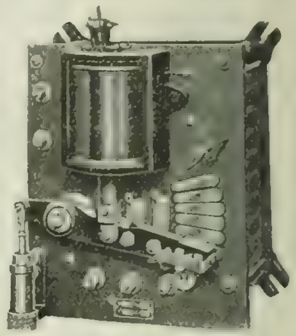
Two Cylinder Engine and Direct Connected Generator

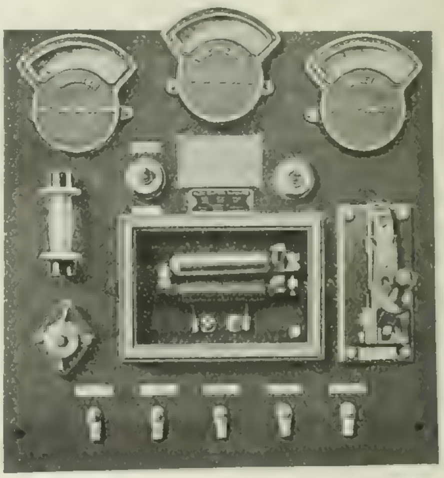
The purpose of the new laboratories is to produce medical serums antitoxins and other biological products of a preventive or curative nature, and to distribute these free or at a nominal charge. Previous to the erection of the present buildings, which are located at Fisherville, about ten miles north of Toronto, the work had been hampered, since its initiation in May, 1914, through lack of accommodation. At the present time the facilities of the laboratories are being concentrated on supplying war needs. For some considerable time all the tetanus antitoxin required by the Canadian expeditionary forces has been supplied by the laboratory.

In connection with the laboratories is a fifty-acre farm, to provide for the animals necessary for the production of the serums and antitoxins. There are two buildings included in the institution—a main laboratory building and a cottage for residence purposes. The main building is a two-storey structure, on the ground floor of which are the operating room, where the horses are bled; a cold-storage room and laboratory, together with stable accommodation. The second floor is largely a hayloft, with accommodation in one wing for such animals as rabbits and guinea pigs, while the other wing is fitted with complete living quarters for the superintendent. The basement contains boiler-room and storage facilities, and houses the pump, refrigerating machine, and electric generator.

The laboratories are self-contained so far as the lighting equipment is concerned. A Lister-Bruston automatic electric lighting plant is provided, which comprises (1) engine and generator, (2) switchboard, and (3) small storage battery. The generator is driven through a semi-flexible coupling by a two-cylinder, water-cooled, slow-speed, gasoline engine. It is of the automatic, self-starting and stopping type, the current being taken from the storage battery to turn the armature of the generator in starting. The storage battery, of 80 amp. hr. capacity, supplies lights up to 10 per cent. of the maximum capacity. When more lights are required the generator is automatically started, and continues operation until all but a few lights are required. The switchboard is of slate and contains the requisite appliances for the operation of the outfit. The capacity is 4.8 k.w. at 110 volts. In addition to supplying light for the main laboratory and cottage, the plant operates the motor-driven pump for the water supply. The ammonia compressor machine in connection with the refrigerating system is also driven, by belt, from the engine. The equipment was supplied and installed by R. A. Lister & Co., Ltd., Toronto.

Controller for Generating Plant





Switchboard for Generating Set

The Dealer and Contractor

British Columbia Electrical Contractors and Dealers' First Annual Convention at Vancouver was Largely Attended—Delegates Present from California, Washington and Oregon Affiliations

A very satisfactory convention was held at Vancouver, B.C., on September 10, 11, to mark the anniversary of the organization of the British Columbia Association of Electrical Contractors and Dealers, the success of which from the day of formation has been in marked contrast to other organizations of the kind attempted in Vancouver during the past twenty years or more. An Eastern visitor, since returned, says of it: "The most successful electrical convention I ever attended."

The meetings were held in the assembly hall of the Hotel Vancouver, C. H. A. Williams presiding over the business sessions. Between fifty and sixty members and visiting electricians were present. Interesting papers (which appear below) were read by Secretary E. Brettell; F. H. Milligan, Northern Electric Company, and T. H. Crosby, Canadian Westinghouse Company. At luncheon, prior to reassembling for the afternoon session, guests were present from Toronto, Winnipeg, Edmonton, and many other points, the speakers being H. Pym, district manager of the Canadian General Electric Company; S. E. Jarvis, of the Jarvis Electric Company, and E. C. Hayward, of Hawkins & Hayward. At the banquet, the same evening, presided over by F. T. Cope, the veteran Vancouver manufacturer and dealer in electric supplies, all listened with pleasure to the excellent addresses delivered by William McNeill, of the Western Canada Power Company, Vancouver, and Albert Elliott, of San Francisco.

Tuesday the members of the association and visitors were guests of the British Columbia Electric Railway Company on a trip to the power-house at Lake Buntzen, the steamer leaving at 9.45 and returning about 6 p.m. Luncheon was served at Wigwam Inn, where further speechmaking was indulged in.

Growth of Our Association

By E. Brettell*

In considering the growth of our association I feel we should pay our respects to those members who were members of prior organizations. Many of us are quite ignorant of the good work that was done by them. I believe that Mr. Cope can tell us that twenty or twenty-five years ago he was associated with an organization that did much for the business, and that many of the associations formed since that time also served a good purpose.

About eighteen months or nearly two years ago, however, the electrical business, as far as the retailer was concerned, at any rate (and I believe the same applied to the contractor), was in a very serious condition. Scarcely any of the men engaged in the business knew one another; a whole lot of us looked upon our competitor as a man to keep away from. If by any chance a dealer ran out of his supply of a certain article, and the wholesalers also could not supply that article, he dared not ask his competitor for fear he should some how or other get after the customer. We even had the spectacle of one dealer starting up almost alongside another and both cutting prices in an effort to make money. Several dealers found the electrical business not sufficiently profitable and turned to other spheres; others less fortunate were forced to close their doors. In the retail section almost a year ago last Christmas the situation, as far as price-cutting was concerned, pretty nearly reached its limit, and then the climax came—a drastic price-slashing incident by a certain company seemed to rouse those engaged in the business, and to that incident may be attributed the birth of our association. At a meeting held early in March, last year, which was splendidly attended, a resoluton was passed that an association be formed much after the lines of those then existing in various states to the south of us. The result was that in a few weeks we had as members a very large proportion of the contractor dealers who were then operating, and we are still steadily growing, for only in the last three weeks more members have joined us. From this association has sprung a similar body, known as the Vancouver Electrical Contractors' Association, a very young organization, which has already shown that it can do much for its members.

Evident Prosperity

In looking over the work that has been done in the last eighteen months, I think we may point to a certain amount of improvement in the condition of our business—members are beginning to invest extensively in motor cars, which in itself is a healthy sign. Whilst many of us feel that our condition has improved there are doubtless a few who think they have not derived much benefit. If only these members will attend the meetings and make suggestions I think they will soon be of a different opinion. It must be remembered that, after all, our association is very young. The executive committee in the past year has had a good deal of worry in connection with the Victoria members. It is felt that perhaps these members have not benefited very much. Although this is a difficult proposition, it is hoped the matter will be taken up at this convention, in order that we may be brought into closer touch with that section. Another point which we might take up is the desirability of enlarging our association and taking in members from the interior of British Columbia, several letters having been received from out-of-town contractor dealers. Whilst the opportunity occurs it would be well to consider the support we have received in the formation of our association. Our associate members have assisted us to a very large extent; at the moment of its birth they lent us their cordial support. They have been present at most of our meetings, but we must admit that during the last few months many of us have doubted whether they were really and frankly sympathetic with the objects of our association. This feeling should now be abolished after the splendid way they have come forward in support of this, our first convention. Now that we positively know that we have their support, I believe the executive committee will shortly induce them to be even more enthusiastic.

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*Secretary B. C. Association Electrical Contractors and Dealers.

We have with us to-day Mr. Milligan, credit manager of the Northern Electric Company, and, although he did try hard to get out of it, he is going to speak today on "Credits." Many of us would like to hear such talks not only at our annual convention, but periodically throughout the year. Perhaps the jobbers might arrange for a luncheon, at which a speaker could address us on collections, bookkeeping, window displays, estimating, etc., or one of the members of the Westinghouse Company might follow out the plan of a booklet issued by that company entitled "How I Did It," and if one of these gentlemen has recently landed a good order, let him come out and tell our members how he did it; how he got in touch with his customer and finally landed the order. I believe we could get many tips from salesmen who have had experience that would be helpful to us in our smaller sphere. It is very seldom that we get the jobbers into our stores; hardly ever do we get any suggestions which might lead to the improvement of our business. If, instead of passing by, our jobbers would walk in and talk, if only for a few minutes, I think the association could be much improved. We want every member, whether he be associate or regular, to take an interest in the association and endeavor to help us build our business.

Appreciation of B.C.E.R. Co.

Turning to others who have assisted us in the growth of our association, I would like to say a word regarding the British Columbia Electric Company. Before the association was formed I think I am right in saying that many of our members were very antagonistic to the British Columbia Electric, and, really, I don't think they had any reason to be otherwise. Chiefly, however, owing to the efforts of Mr. Walker, sales engineer, a great change has taken place. A letter from General Manager Kidd this week expresses his great interest in the welfare of this association, and at the banquet to-night we shall hear why he gives us his support. We have been told in times past by officials of the company that we were not aggressive enough—that we did not get after the business. Is it not hard to work up any enthusiasm when prices are being cut to pieces, as they were before this association was formed? I would like to see a retail committee formed from this association which could meet the representatives of the British Columbia Electric and form some plan to place more appliances on the lines. A copy of the business of the last meeting of the California association has recently come to hand, and it is interesting to note that a similar feeling exists in that association. At this meeting consideration was given to a state-wide campaign for the promotion of retail sales, under the direction of the California association, with possible joint direction and assistance of central stations, jobbers, and manufacturers, the contractors share of estimated total cost of such campaign not to exceed $1,500. It was decided to call upon all members to contribute $10 each to create a fund. In our province could not a similar matter be taken up? I was much struck when looking over the wedding presents for a very large wedding in this city last year to note that out of all the gifts—and there were a great number—only four were electrical: an electric iron, a toaster, and two reading lamps. Surely there is something wrong when we supply only four out of probably 150 or more gifts! This fact alone gives scope for much thought.

I feel, also, we should express our thanks to one other section that has assisted us in our growth. I refer to the Washington, Oregon, and California associations. Washington helped us in our birth; Oregon has shown herself very interested in us, whilst California has been a tower of strength to all the associations on the coast. It was only on Friday last that I was able to get the name of the president of the newly-formed Alberta association, and we hoped by sending a telegram immediately that we might have him with us. However, that must be left for some future convention.

Credits, Cash Discounts, Turnover

By F. B. Milligan*

One reason, I understand, why I was asked to submit a short paper on "The Matter of Credits Since the Birth of the Association" is because my position as district credit manager for the Northern Electric Company would enable me to express my views in this connection from actual experience with our customers who are members of your association.

It is most gratifying to be able to say—and I believe the statement will be confirmed by our competitors— that there has been a marked improvement in collections and a much larger percentage of our customers taking advantage of the cash discounts; and, further, I am glad to be able to advise that there have been no failures in the electrical business since the birth of the association. This shows a healthy condition of affairs, and is due no doubt to the closer co-operation of the electrical trade, brought about by the formation of your association. This practically covers the subject I have been asked to speak upon, and I may be permitted to touch upon some phases in connection with credits and the success of your organization, which will doubtless be of interest to you.

I would like to say that, if your organization is to be a success, your members must become saturated with the association spirit, as it will make better merchants of you and better citizens. By meeting your fellow-merchants at your gatherings you have opportunities of discussing together many commercial problems, both giving and taking advice. A serious obstacle to organization work is the large number of retailers who, having but little knowledge of business principles, cannot see the benefit which an organization might give them. It then devolves upon the loyal members of the association to educate these people to the benefits of organization. Consideration, courtesy, and right intent all add to the sum of human happiness. Not only do they benefit those to whom they are extended, but they survive in various forms and add to the well-being of the business world. Quality, plus service, is the basis on which prices are made. Competition in quality and service is a healthy condition, but competition in price alone tends to business ruination.

Profit Depends on Turnover

It goes without saying that we are all in business for the net profits we can make. The two ways of increasing the net profits on a given volume of business are to keep the expenses down and to increase the gross profits without correspondingly increasing the expenses. We all realize that net profits depend on gross profits and expenses, but there is a keen appreciation of the fact that net profits also depend to a very large extent on investment. The net profit of any particular sale is, of course, the cost of the goods, less the expense of doing the business; but the net profit for a year is determined by the number of sales. If a merchant's capital is tied up in an unwarranted investment the number of his sales, unless his borrowing capacity is unlimited, is necessarily decreased—that is, he hasn't money available for the purchase of goods to sell at a profit, and, of course, his net profit for the year is reduced.

For example: Suppose that a merchant has an investment in merchandise equal to sixty days' sales (which may be considered a fair standard). Then, if his investment in receiv

Northern Electric Company, Vancouver.

ables is equal to thirty days' sales, he has a total investment equal to ninety days' sales; that is (since ninety goes into three hundred and sixty four times), he is turning his investment over four times a year. If the net profit of each turnover is 5 per cent., he makes a total net profit of 20 per cent. on his investment. Now, suppose he isn't so good a collector; he collects in sixty days instead of thirty. Then he carries an investment in receivables equal to one hundred and twenty days' sales, and gets three turnovers a year instead of four, making a total net profit of 15 per cent., as a result of allowing sixty days' credit rather than thirty; and if he collects in ninety days, he carries an investment equal to one hundred and fifty days' sales, turns his investment over two and two-fifths times a year, and gets a net profit of 12 per cent.—a decrease of 40 per cent., as a result of allowing ninety days' credit instead of thirty.

Twenty-five per cent. on $100 wouldn't feed a big family very long, but 10 per cent. on a thousand dollars is four times as much. The rapid turning over gives volume and increases your cash discounts rapidly. One hundred dollars turned twelve times in twelve months, with a 2 per cent. discount every thirty days, will give you 24 per cent. margin every year. If you made no greater profit, and your capital is sufficiently large, you can make all the money your need.

A good assortment is one of the fundamental principles of a successful retail store. The jobber is best fitted to supply that demand. Quick sales and fair profits bring great results. Your total net profit for each day is what counts; therefore, it is necessary for you to know what you have done to-day, and, if you show no gain, try a different plan and work harder to-morrow. You must have a goal, and try to make it.

I am glad to have been privileged to address these few short remarks at this gathering, and trust that the discussions at this convention will be of much benefit to your members.

Future Business

By T. H. Crosby*

We are, I think, all subject to varying moods—to periods when everything seems rosy, and when we would gladly undertake nearly any kind of proposition which would afford any hope of gain, and which would probably be carried through successfully if it were pushed continuously by the enthusiasm of that hour. On the other hand, we all have moods when we look upon things about us with eyes that see only very meagre chances of profit and success. In these moments we view the future with misgivings and doubt. We make excuses for our own lack of greater success, claiming that our field is overworked, and that we can hope for but little progress in our business, and that we will be fortunate if we are able to keep things going even as they are at present.

As we all have these ups and downs, it was thought that a recitation of some of the more evident opportunities for new business might perhaps serve to better our viewpoint as to the possibilities of our trade, and also help that fund of enthusiasm which is, above all, necessary to the full development of our own powers and of the market which is rightfully ours. To this end our enthusiasm is necessary, as we have no other means so good by which we can give our customers and our prospective customers—the public—the desire sufficient to part with their wealth, or a portion of it, in exchange for some article of electrical merchandise or service. This enthusiasm is, without doubt, the soul of business. We have daily evidence of the fact. Enthusiasm, above all, will sell our goods and in remarkable quantity. But they will not, of themselves, necessarily "stay sold" and be the means of increasing business, bringing duplicate orders and increased profits unless our enthusiasm is founded upon facts. All our claims, however enthusiastically made, must be carried out by our articles of merchandise and service in the cold, practical light of every-day use.

This is the reason for this paper—that we may, in a general way, look into a few of these uses of our electrical products—uses to which they are now put, in what state of development they now are, and what fields are open before us for new business. We will, without doubt, in this way find that we have no reason to fear the future—that the electrical art, which has so transformed and bettered our condition during the past generation will still show more usefulness in added conveniences and labor-saving methods, and that these new uses of electricity will give us all full scope for our efforts in properly marketing the necessary articles. When we see that the future of our business holds the same room for increase that has been realized in the past we then have the firm ground of confidence beneath us, and our enthusiasm, initiative, and push will bring proportionate rewards. We need not fear that our business will suffer the setback of a development beyond the need, such as has been the fate of most real estate "booms."

Any remarks, then, which are made here concerning activities of the near future are not to be considered as being in any way clairvoyant, nor in any sense as being delivered by a prophet nor the son of a prophet. It also may be said here that none of this paper will even attempt to be of a prophetic nature, but will only deal with a few of the developments which are at hand, and which will surely form a considerable part of the stock-in-trade and commercial paraphernalia of those engaged in the commercial end of the electrical art.

Development Year by Year

From the past we are acquainted with developments which, one by one and step by step, have led us through series of evolutions to the state in which we find them at present. This is true of all portions of our civilization and social structure, whether it be in social relations, the arts, industries, or commercial and business activities. So we find in history that each succeeding period has developed wants and needs that were the natural outgrowth of the wants and needs of the preceding years. Thus the business of the future is the natural outgrowth of business of the past. An examination of the progress made along any line up to the present, and a consideration of the degree of perfection already obtained, will, in many cases, show what may be expected in the near future in this line of business.

Only during the last generation has electricity been in general use. Less than forty years ago we had the telegraph, only in a form somewhat less perfect than that in which it is now used. The telephone was not in general use. The electric light was just commencing its career as the one best illuminant, though as we look at the poor carbon filament lamp of those days, usually burned at a voltage too low or fluctuating, the improvements in electric lighting since that time seem to be of greater importance than the introduction of the first electric lamp itself. Electricity had not then made urban and interurban transportation and travel the convenience and comfort that it is to-day. The electric heating device and the omnipresent electric motor of to-day were unknown a few short years ago. The field of usefulness is to-day being rapidly increased, and new requirements will have to be met continually.

Our business activities as electrical dealers, contractors, and salesmen are dependent, in common with all other businesses, upon two things—supply and demand. This expression "supply and demand" may be a somewhat hackneyed phrase, used so often expressing conditions that we consider inevitable and over which we have no control. These conditions should not be considered as limitations, but rather as opportunities, as both are, fortunately, in our case subject to huge development.

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*Canadian Westinghouse Co., Vancouver.

The supply in our sense of the term is the product in electrical appliances which have been commercially developed for use in the production of electrical energy and for its use in the industrial and domestic field. Some of these products now show radical tendencies in development and design from their present state to a more standardized and useful form, while in other cases we may consider that the article as now marketed is fairly well standardized, staple in design, and not subject to much further development in its present form.

The demand in the electrical trade is the requirement of the public for these products, and is, of course, equal to the present supply at least, but is also subject to change, and will show a remarkable growth in accordance with social requirement and in proportion to its ability to increase industrial and domestic efficiency and convenience.

Efficiency Is Very High

The distribution and use of electricity exhibits at the present time very high efficiency, and, in fact, depends upon its greater flexibility and efficiency for its hold upon the community. It is, therefore, only what would be expected when we find a number of types of electrical machinery which are extremely high in efficiency. The static transformer gives efficiencies of 98 to 99 per cent. in moderate sizes, and even higher in the largest units. The alternating current generator, which is the means of production of the major portion of electric power as now used, gives efficiencies of 94 per cent. to 97 per cent. The alternating current motor is efficient to a high degree, in cases 94 to 95 per cent. being obtained.

With such close approaches to 100 per cent. efficiency, or perfection in the elimination of losses, there is but little opportunity for improvements of a radical nature in these machines. At best we can hope to get but little more energy out of these devices, compared to what we put in, than is now obtained. Changes will, of course, be made in such apparatus from time to time. Established standards will be modified to suit special conditions; constructional costs may be somewhat reduced by more economical designs and by increased production, but the most radical change in physical make-up of such apparatus cannot radically affect the over-all efficiency, as the losses are already so small, and are in many cases negligible, compared with any other means of transmitting energy. This class of equipment can, therefore, be considered as standardized, and changes will not be of a radical nature. The marketing of these machines will be carried out for some time to come, under conditions similar to those with which we are all familiar.

In the field of the small heating and cooking appliance the cleanliness and convenience of electricity has enabled the use of electric household devices to be successfully increased far beyond what would have been thought possible eight or ten years ago. In sombre moments it is even sometimes thought that the sales of such articles had reached a peak or climax—in fact, that this zenith had, perhaps, been passed.

This viewpoint, though, is hardly tenable when we consider the basis upon which this business has been built up. It is true, I believe, that the major portion of all household electric devices are used, not on account of cheap first cost, nor even on account of cheapness of operation, though here we must not forget the marked effect of the material reductions in the rates for electricity for domestic use that have been made in recent years. Convenience and cleanliness have been the best selling arguments, and have caused the more common devices to become the rule rather than the exception in the average household. In fact, our social standard demands certain of these electrical conveniences. And, when such a demand is established quibbles over the purchase price, and even the cost of operation, fade into thin air, and, instead, the user will even pride himself on expensive investments in such articles, and he will consider the sturdiness of his power bill as an index of his social standing among his neighbors.

This demand that can be created by the social requirements of the community is really the one thing which more than anything else will provide an ever-increasing market for us. We can all remember the time when the oil light, or even the candle, was the rule. The average person then considered electric light merely as a luxury and an innovation. In many ways it was thought not so desirable as the kerosene flame, which could be readily turned up or down to provide the desired volume of light. Brilliancy then was not desired beyond the range of this lamp, and also it was portable. In many cases also gas lamps held out against its electric competitor to the last ditch. The viewpoint of the user with regard to the now common electric lamp has changed to a far greater extent than even the quality of the electric light. Now in the modernly-built city or town, and even country district, electricity is taken for granted as the only desirable form of illuminant, and would be installed in 90 per cent. of the cases if its cost were twice as great.

Electric Appliances in the Home

With the lesson of the electric light in mind, and the insistence with which it is demanded for illumination, and the almost pathetic struggle of some of the smaller towns to attain to the municipal standard of the ambitions by the installation of an electric light plant in view, we immediately see a land of promise for future business in the domestic use of electricity for major cooking operations and general heating. We have in the last generation in the home discarded to all intents and purposes the old wood and coal stove in favor of the central heating furnace, which distributes the heat to the various rooms of the house. Why should we not in the next few years see the coal-fired furnace superseded by the electric furnace for house heating, or rather electric heat supplied to each room? Cost of operation will only for a short time prevent this electric heat being used generally in all localities having an adequate supply of electric power.

Electric cooking will be even more generally adopted, though gas may be offered or be in use, with its marked advantages over the comparatively unregulated heat of the coal or wood stove. The electric way, being here as elsewhere more flexible, reliable and convenient. Long lists of statistics could be given to show the operation of these heating and cooking devices, but would be out of place at this time. However, they would serve to show that at a power rate which may be shortly expected to be offered, that electric heating, with fair credit allowance for extra convenience, availability on short notice, and minimum of attendance required, can easily compete with coal at a price not so far above the present price. Electric cooking, from the same statistics, will be found to be not at all the expensive luxury that it is now considered by many people, and we will soon all be wondering why it has been even this long delayed.

The manufacture of apparatus for such uses is, in most cases, far beyond the experimental stage, and is definitely standardized in certain lines. Reductions in rates we now have for this purpose, and no doubt will have to a further extent from time to time, but the rate question in any event need not be a permanent discouragement. With the installations already made we have the nucleus around which will grow up the social demand for heating and cooking in the electric way. There is here an immense field for the dealer and contractor, without in any way wandering from the field of the certain into the realm of mere probabilities. With the rising price of coal, due to the constantly increasing cost of obtaining this fuel, and also due to the visible limit of the supply, communities such as this will readily adapt the electric way, and it would be a short sighted sinner indeed who would seriously consider our field as limited when along this one line alone there should be a prospect of doubling the wiring installation in our own city and of selling to present users equipment probably fivefold the value of all the electric devices now in use by them.

Opportunity in Light Developments

Even the incandescent bulb, which has seen such marked improvements, is due to pass through still more development. Here the ratio of energy used as light is very small compared to the energy dissipated as heat directly, so, contrary to what is the case with motors and generators, there is a field which may at any time be invaded with radically improved apparatus. The volume of business thus created may far exceed that caused by the introduction of the tungsten filament lamp. We have at hand even now the daylight lamp—this season's contribution to improved lighting. Here is the opportunity of introducing a virtual artificial daylight, cold it is true, compared to the comparatively yellow light of even the gas-filled lamp, but unequalled for color-matching or use in any location where color effects are important, or where eye-strain may result from the use of ordinary artificial light.

We have not mentioned in this discussion a great many new fields which are more or less remote to us, but which may still in time be of great interest, such as electricity in the chemical industries, the use of electricity for the stimulation of plant growth, which it would appear may be used in part as a substitute for the ordinary methods of fertilizing and enriching the soil, and also as an excellent substitute for ordinary sunshine. There are also schemes on foot to use electricity to stimulate mental activity in school children (and why limit it to children?)

But these are beyond our consideration at the present moment. We have seen, however, ample fields open for our endeavor which will, in themselves, be sufficient sources of business for some years to come, business sufficient to allay any doubts and fears as to future opportunity, and sufficient to make us feel that we are engaged in a business that is bound to grow, to give service, and to receive the fair profits that should naturally follow.

Toronto Electrical Contractors Are Boosting

the Victory Loan as Well as Their Own Business—Innovation Arouses Keen Interest Among Members—Next Meeting is First Anniversary—Don't Miss It

The Toronto Electrical Contractors' Association have just issued a special pocket edition, sporting extra, four-page newspaper called "The Association News.' It is an interesting little publication, and should be the means of accomplishing the ends for which it was designed, viz., to arouse some interest in those electrical contractors who, to use a common term, have been more or less slackers as regards attendance at the regular luncheon meetings of their association. The leading editorial speaks of the difficult situation in which the association found itself at 8 o'clock on the evening of November 1 at the Carls-Rite Hotel, and of the masterly tactics which resulted in one of the most helpful and enthusiastic meetings the association has held. However, as a result of investigations into the cause of the rather slim attendance it was decided that in future the dinner should begin promptly at 7.30 o'clock, "whether anyone is there or not." Also the previous practice, which had been discontinued temporarily, of selling tickets for the next meeting has been re-established. Indeed, the enthusiasm in that latter connection was so great among the members present that every man not only bought a ticket for himself but also for at least one absent member, and some of those present took several extra ticketc. In all, 43 tickets were sold out of a possible 51, so that the next meeting is certain to be very fully attended.

Boosting the Victory Loan

One of the most interesting items in connection with the meeting was the decision of the association to purchase a Victory Loan of $500 denomination. The suggestion was made by Mr. Evans, of Elevator Specialties, and unanimously and enthusiastically accepted. The loyalty of the Toronto electrical contractors is also evidenced throughout the Association News, one complete page of which is given over to a telling Victory Loan advertisement, in addition to smaller references on the other pages.

Harry Beach Talks About the Credit Man

The talk by Mr. Harry Beach was so good that no member could afford to miss it. The Association News has the following item in this connection:

"With the meeting warmed up, Harry Beach was off to a good start, and before long we forgot he was a 'Credit Man.' He told us all about these new-fangled relations between the 'Credit Man' and us poor 'Debtors.' He says the 'Credit Man' wants to see us get along. If we have troubles, he's right there with the good advice. Make friends with him every time. Following Harry's talk came our vote of thanks; none the less sincere because formal."

Not the least interesting item in the Association News is the Social Corner, where appear the names of those who were present and also those who were "reported missing." The number of "casualties" under this heading was distressingly large, and we trust that General McIntyre and Lieutenant Myers will be more careful of their men in the future engagements.

A column of editorial paragraphs are much to the point. Victory bond exhortations figure prominently. The editor has also compiled a list of choice contractors' literature, which we hope will be found in every member's library; and, finally, we are reminded that the anniversary of the formation of the Toronto Electrical Contractors' Association is upon us, and that to Frank T. Groome, the Benjamin-92-idea sales manager, we are all greatly indebted. Follow the editor's injunction by all means, but please don't all speak at once.

On page 4 a number of small advertisements appear. Many a contractor has odds and ends that may be just what a brother contractor is looking for—a good form of conservation of material in these days of scarcity and high prices.

The Place of the Jobber in the Electrical Trade

In addition to the talk by Mr. Beach, an interesting paper on "The Place of the Jobber in the Electrical Trade" was read. This paper had been prepared originally by Mr. E. W. Moore, president of the Electric Cable Company, and presented before the National Jobbers' Association. The paper is as follows:

Place of the Jobber in the Electric Trade—Manufacturer Ought to Protect Him

While nobody can dispute the fact that the man who buys only $5 or $6 worth of wire must buy it in a certain way, still there is considerable argument as to how the man who buys $100,000 worth of wire should do his buying.

Now, as the value of the wire itself is probably the larg est single item in the electrical equipment of a building, with the exception of the labor, it pays the owner, the architect, and the wire manufacturer to spend a considerable amount of time on the proposition.

The feeling is fostered that the architect and owner of the building prefer to deal with the manufacturer, really ignoring the contractor, although he installs the wire, and totally eliminating the supply jobber. This condition complicates matters to a great degree, and furnishes one of the jobber's most serious complaints, particularly in the East, against both the manufacturer and the contractor.

Their Own Electrical Department

On the other hand, a great many of the large industrial plants, because of their growth, have developed the habit of operating their own electrical departments, which electrical department almost always expects to deal directly with the manufacturer, and this action seems, to a certain extent, to be justified by the size of their purchases.

These conditions all make for a lack of policy on the part of every individual connected with the transaction, and this lack of policy is made more disastrous in its results to the trade by the rapid fluctuations which are always taking place in the price of copper wire, which further complicates the situation, and at times produces a condition of absolute demoralization in the business, during which time nobody makes money. This demoralization has been corrected by the extraordinary times which we have for the past year and a half; but we desire to most earnestly warn everybody connected with this industry that a return of the normal business conditions will result in the most heart-breaking competition unless steps are taken by everybody concerned to stabilize the business now under the present conditions

Cost Accounting

One of the essential factors in stabilizing business and preventing demoralization in price is establishing among manufacturers, contractors, and jobbers an accurate system of cost accounting. The lack of such a system lies at the foundation of destructive competition.

As I said before, we have given this matter very close and serious attention for the past two or three years. Many of the conditions above mentioned have borne upon us severely at times, and we have seen conditions in the wire trade which we could only consider lamentable.

Blames the Manufacturer

I personally, am inclined to criticize the manufacturer as being the cause of a great deal of trouble. Upon accepting this conclusion, the natural outcome would be to brand our goods, advertise the brand, and endeavor to create a demand for it which would be treated along stable policy lines. While we have only gone a small distance along the line we purpose to follow, the results are extremely gratifying, and I desire to explain to you just what our conception of business is and how we propose to handle it.

So far as we are concerned, we do not regard wire as sold until actually installed in service. In other words, we feel that, after we have made our sale to the jobber, it is up to us to help him with the sale of the wire to the contractor, and after that we must help the contractor to sell it to the owner.

The Owners' Viewpoint

Every one of our policies, therefore, is carefully scrutinized from the owner's point of view. We believe that there is nothing in the long run that will prove so economical to the customer as distribution through the jobber and contractor. You will note we say "economical"—not "cheap." We are now reaching a solution which will afford us a solid sales argument to the contractor, and which will strengthen and uphold his stand, thus putting your customers in a better and more satisfactory position and in a condition of more profit to you.

We believe, as we have said, that we are not far from solving this proposition, and when we have solved it, and have created a satisfactory market for our material with the contractor's customers, we have no doubt in the world that he will see the wisdom of dealing with the jobber, and that he will establish fair and satisfactory relations with him. We believe that within a short time we will see our business flow through regular channels.

Protect the Jobber

It is our intention to protect the jobber in every way possible. We realize that the jobber is severely handicapped in doing business by the necessity of carrying a stock, by the maintenance of a warehouse, and by the credit risk which he is absolutely obliged to take in the case of a large number of small customers, and for that reason we think the jobber should be protected by granting him a lower price than anyone else will receive who does not accept the same obligations. The same applies to the contractor, as he lightens his burden by making the jobber carry a large stock and a large force of salesmen, while he himself is only carrying a small stock and considerably less sales' expense, so he, too, in turn will be protected against the customer who carries none of these burdens, and who, consequently, must pay a profit to the contractor and the jobber.

Quality and Service

It is our idea that "quality" and "service" are the two things which the owner of the building is entitled to have. We will furnish the "quality" and stand responsible for it, but it is up to the jobber and contractor to furnish the service and in order to furnish the maximum amount of service for the ultimate customer, it is our idea to give both the jobber and the contractor the protection to which they are entitled. We are of the opinion that this can be brought about in such a way that business will flow through these channels simply because it is easier and more economical. We are not in the least afraid we are not going to succeed in our policy, because we have already attained success, even though our policy is not as yet fully worked out in all its details.

We do believe, however, that we should receive cooperation, and thorough co-operation, from the jobbers. We do not want the jobber to go around and say that he handles two kinds of wire—one "quality" and one "cheap." This, we believe, is the way it is usually expressed. We do not think any jobber should handle anything but good wire, and this does not mean either that we expect all of the electrical supply jobbers in the country to sell nothing but our material.

Use Standard Wire Only

We do feel, however, that no jobber should sell or buy any wire because it is cheap. He is neglecting his obligations to the public when he adopts this attitude. If he is now handling what is known as a "cheap" wire, he should immediately investigate the supplier's methods, both manufacturing and selling, and make absolutely certain that nothing is neglected in inspections, and satisfy himself that the material is up to the proper standard. If he cannot make his manufacturer conform to a proper standard, then he should cut him out. The manufacturer should receive co-operation from the jobbers in working to the highest possible qualities. The "price" argument should be relegated to a secondary position, and the jobber should limit himself to selling on "quality" and "service" arguments. The customer should have what he wants and needs. Sometimes the "wants" and "needs" are not the same, and the salesman who keeps his mind on the "needs" is the one who wins out in the long run.

Recognize the Jobber

We cannot emphasize too strongly to the jobber the importance of driving every manufacturer to adopting a standard policy of recognizing the jobbers. This is the only sane policy in the electrical business, and if a manufacturer is not intelligent enough to adopt such a policy, then his selling methods are open to criticism, and when any of his methods are open to question, his manufacturing methods are also under fire.

In cases where we have secured our orders from the individual owner we propose to clear the order through the contractor, who, in turn, we shall require to deal with our jobber in his particular district.

This campaign will be conducted by general magazine advertising, by personal solicitation, and in such other ways as may seem advisable from time to time. It will be accompanied by canvassing architects, engineers, lighting companies, and individual plants.

Systematic Retailing

Every effort will be made to decrease the competition business of each contractor and to increase their non-competitive business; to prevent electrical work being done by anyone but an established standard contractor; to force all retail business to the contractor; to have the contractor deal with the jobber entirely on all electrical lines, and to insure all stages of these transactions being accompanied with a reasonable profit.

The Jobber's Duty

So much for the general policy. Now as to the jobber's part. The jobber must accurately examine his cost of operation and sell no wire except at a profit. He must insist on buying and selling a "quality" article only. He must deal on prices based on the market, wherever possible, and he must adopt a policy and stick to it. Don't let a salesman who has been unable to sell a standard article come along and show his ability by talking you into using a cheap article which is sub-standard. Convince yourself that what you are doing is absolutely right, and convince your salesmen, and they will get you the orders; but make your policy and stick to it through thick and thin.

REASONS WHY WE SHOULD ALL BUY A GOVERNMENT BOND

1. It is a patriotic duty.

2. It is an excellent investment, yielding over 5½ per cent.

3. It is an absolutely safe investment.

4. It is free from war taxes—which are piling up.

5. You can always borrow on it up to practically the face value.

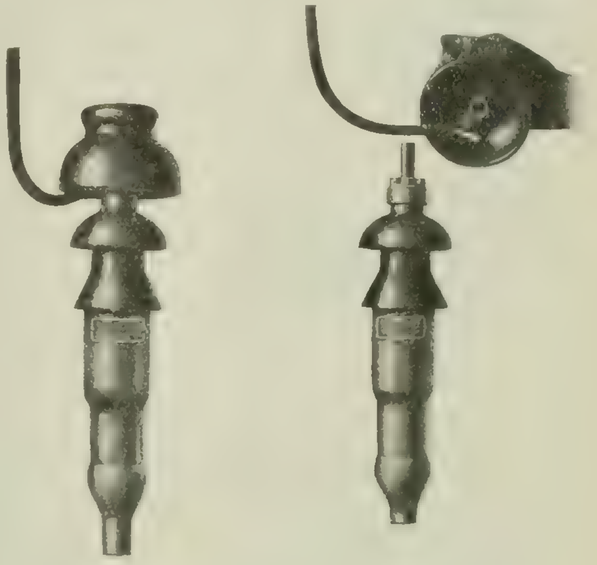
6. It is always saleable at a moment's notice.

7. The proceeds of the loan will be re-distributed in Canada—immediately. This means that every workman, every retailer, every dealer and jobber, every manufacturer, every supplier of raw materials, will get his money back through the usual business channels.

For electric decoration purposes, such as on Christmas trees, in rooms, and also out of doors, Shaydolite, marketed by Spielmann Agencies Registered, Read Building, Montreal, has been used with excellent results. The lacquer is supplied in many shades. The lamps must be clean and dry and then dipped into a cup of Shaydolite until submerged, and afterwards slowly withdrawn. They should be dried with the current on.

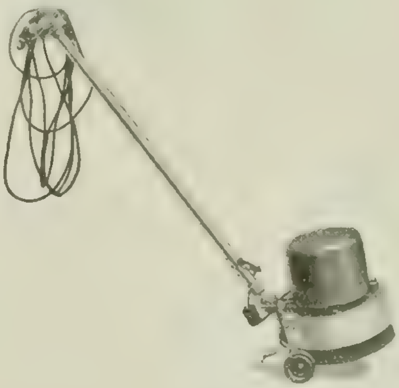
Outdoor Cable Terminals

A new style of outdoor (type D.O.A) cable terminal has recently been placed on the market by the Standard Underground Cable Company of Canada, Ltd., Hamilton, Ont. It is known as the protected disconnection style. All the copper parts are covered by a porcelain hood, as shown in the illustration, which permits the disconnection of the aerial extension wire even while the circuit is alive. All the outdoor (type D.O.A.) cable terminals made by the Standard company are readily disconnected from the aerial conductor either by means of a set-screw, cap-nut, or turn-buckle stem. The stem of the new terminal is a modification of the regular cap-nut stem, and has some additional advantages where frequent disconnection of the aerial circuit from the terminal is necessary. The new terminal, as well as the complete line of Standard outdoor cable terminals, is fully described in Bulletin No. 700-2.



Electrically-Driven Machine for Polishing, Scrubbing, and Sanding Floors

The Utility floor machine, manufactured by the Kent Vacuum Cleaner Company, is provided with four interchangeable attachments, one for polishing waxed floors, one for scrubbing floors of all types, one for removing varnish, and one for sanding floors. These attachments are a steel wire brush, a palmetto scrubbing brush, a tampico polishing brush, and a sandpaper disc. These attachments are circular, and are rotated continuously in one direction as the machine propels itself over the floor.

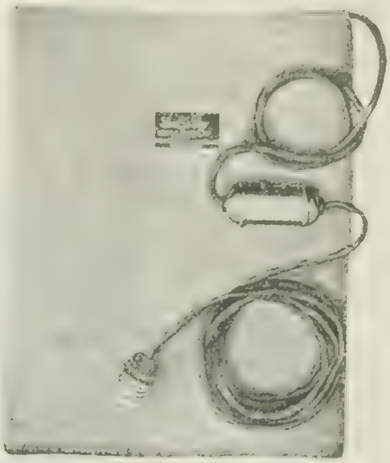


When the operator raises the handle slightly the machine moves to the right. Lowering the handle causes it to move to the left. Twisting the handle slightly in one direction

(Continued on page 36)

Suggestions for Christmas Buying

Coffee Percolator—Northern Electric

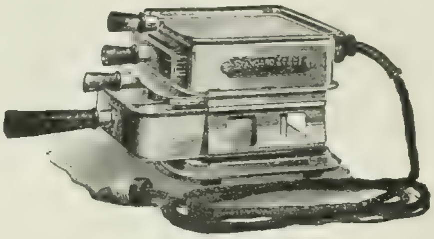


Sun Ray Heating Pad—
Northern Electric

Northern Electric Upright Toaster

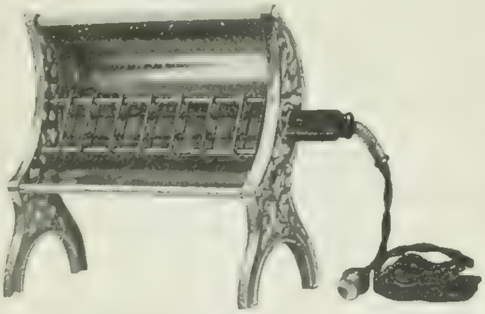
Northern Electric No. 2 Iron

Northern Electric Chafing Dish

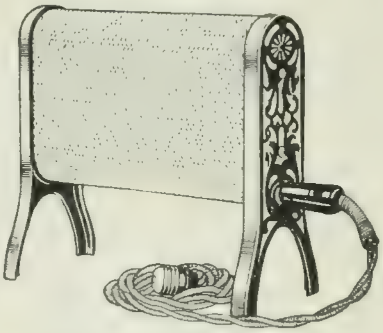


Standard Table Stove—
Northern Electric

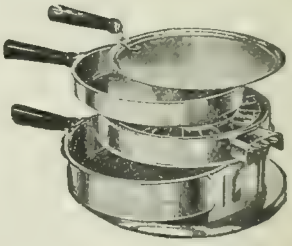
C. G. E. Engine & Carburetor Heater



Glower Heater (new type)—
National Electric Heating Co.



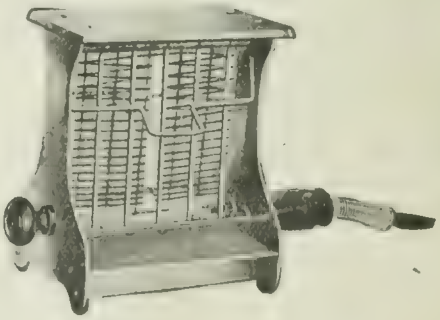
600 Watt Air Heater—
National Electric Heating Co.



Universal Four-heat Grill—
C. G. E.

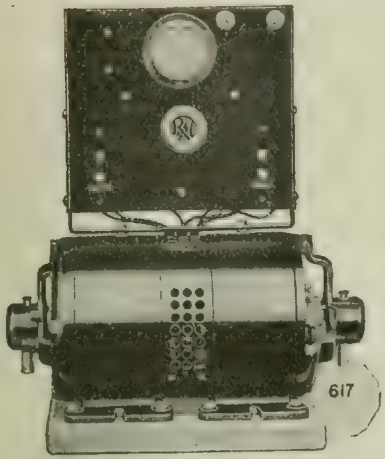
Sew-E-Z Motor—C. G. E.

"Universal" Coffee Urn—C. G. E.

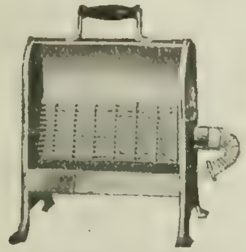


"National" Toaster

Suggestions for Christmas Buying



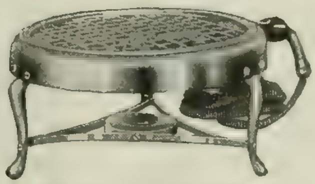
Robbins & Myers Battery Charger



"Universal" Radiator—
C. G. E. Co.

"Universal" Immersion
Heater—C. G. E. Co.

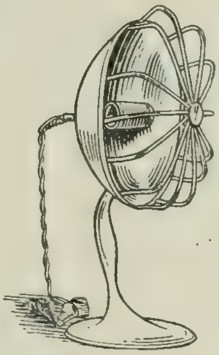
Electric Fireplace—Rose & O'Hearn



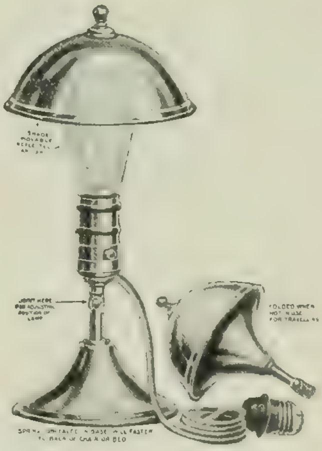
Toaster Stove—Renfrew
Electric Mfg. Co.

Renfrew Electric Iron

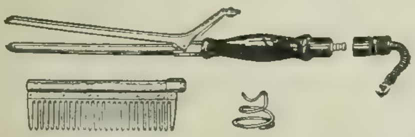
"Renfrew" Grill with Three Pans



The "Majestic" Heater

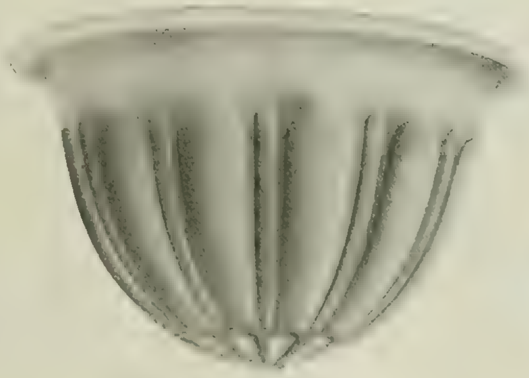


The Wallace Lamp—Menzies & Co.



"Universal" Curling Iron with Hair Drier—
C. G. E.

Glassware for the Home—
Jefferson Glass Co.



Jefferson "Moonstone" Semi-indirect

Bell-ringing Transformer—
Hatheway & Knott

causes the machine to move forward. Twisting it in the opposite direction causes it to move backward. The weight of the machine is 15 pounds, which causes it to put a pressure on the floor much in excess of that which can be applied by hand. The machine can be operated with ease by maids, scrub-women, porters, or any unskilled help. With thirty minutes' instructions it is claimed that any porter can cover 2,000 square feet per hour with the machine. It is claimed that one inexperienced operator can do two to five times the amount of work which can be done by hand.

In refinishing hardwood floors one man using this machine can remove paint, shellac, or varnish at the rate of 75 square feet per hour under ordinary conditions; and where the floor is in very bad condition, requiring the removal of a great deal of the finish, a man can clean space at the rate of 50 square feet per hour. Floors can be sandpapered at the rate of 100 square feet per hour. Waxed surfaces can be polished at the rate of 2,500 square feet per hour, and will have a hard, lasting, brilliant finish, not easily marred. This is because the high speed of the brush causes the first coat of wax to heat by friction, melting it into the pores of the wood, and thereby acting as a filler. A second light coat can then be polished to a brilliant finish. The results are also claimed to be more uniform than can be obtained by hand, as the pressure and speed of the brush never varies. The machine is practically noiseless in operation, and can be used to scrub around beds in hospitals without causing annoyance to the patients.

The machine is operated by a 1/6 horse-power, 1,750 r.p.m. motor. The speed of the brush is reduced to 200 r.p.m. through a reduction gear drive. The motor is completely enclosed, and the entire machine is provided with an aluminum case, thus obviating any danger of the revolving part striking and injuring furniture, baseboards, etc., and making it possible to operate the machine against baseboards and close into corners. The motors used are a special design, made by the Robbins & Myers Company. They can be furnished for operation on 110 or 220 volts direct current or alternating current of 110 or 220 volts of 25, 40, and 60 cycles.

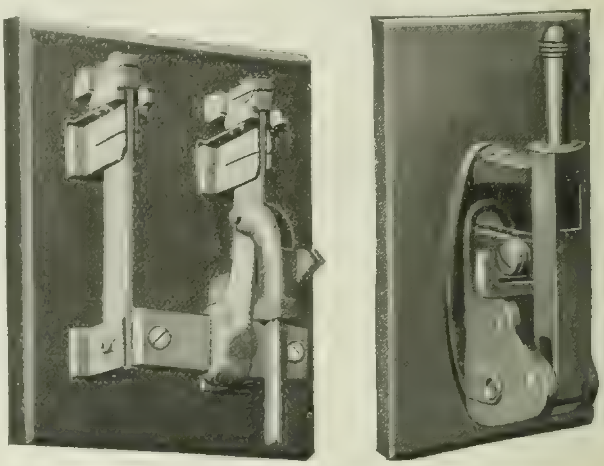
The Electric Canoe

Electric canoes are becoming very popular on the Upper Thames, states a recent issue of the English publication "Motor Ship and Motor Boat." The first electric canoe was launched in June, 1908, and has been followed by other designs, each showing an advance over its predecessor. These canoes are constructed with additional strength to provide for the extra weight of the motor, which is placed amidships, together with the battery, leaving ample room forward and aft for passengers. Some of the canoes provide comfortable accommodation for eight passengers and others provide for only four. The most modern "electrics" have steering wheels operating a three-bladed propeller through a pinion and a ratchet. A 30-cell battery is commonly used, which has a capacity for one day's run. The electric canoe has many advantages over the petrol-driven launch, as it is silent, free from vibration, and does not travel at a speed that causes any appreciable wash. Many boat builders on the Thames have installed charging equipment, and the electric canoe has already proved so popular that it bids fair to bring about a revolution in mechanically-propelled craft on many rivers, dependent only on adequate charging facilities.

R. E. T. Pringle, Limited, are distributing a hanger illustrating and describing Hubbell reflectors and reflector sockets for Mazda lamps. The reflectors are printed in colors, and so arranged in relation to the various sized lamps that no difficulty can arise in the selection of the correct type and size of reflector for any lamp. Distribution curves for the various reflectors are also shown.

Back of Board Type Field Switches

In the starting of a synchronous motor from an alternating current source with the field open-circuited, which is the practice of the Canadian General Electric Company on all a. c. motors using 125-volt excitation, there is considerable induced voltage across the field terminals until the motor reaches synchronous speed. Under these conditions an exposed field switch on the front of a switchboard is more or less of a source of danger to the operator. The most approved method of reducing this danger in connection with hand-operated field switches is by means of the back of board switch shown. This switch embodies all the essential features from a safety-first viewpoint. It consists of an operating handle, similar to an oil circuit breaker lever, mounted on the front of the board and the switch proper, mounted on a slate base, which is supported on a framework back of the switchboard. The switch is connected mechanically to the operating handle by means of connecting rods and bell-hangers. This locates all live parts on the back of the board and does away with danger of accidental contact to the operator from the front. This type of switch is used also in connection with alternating current generators when it is desired, to reduce risk to a minimum.



When solenoid-operated field switches are used in the field circuits of synchronous motors started from the alternating current source, they are ordinarily made of two single-pole elements, with independent closing and opening coils. Both poles are closed simultaneously, but, in opening, one pole precedes the other, connecting the discharge resistance across the field, the other pole opening immediately after and interrupting the discharge circuit, and entirely disconnecting the field circuit. On synchronous motors utilizing 250-volt excitation it is the practice to start with the field short-circuited through the discharge resistance. In such cases a double-pole switch is provided to short-circuit the field through the discharge resistance during the period of starting. Solenoid-operated field switches for synchronous motors started with the field short-circuited are double-pole, with common closing coil and common opening coil. No provision is made for automatically interrupting the discharge circuit after the switch is opened, although the discharge blade can be opened by hand.

> **"The man, be he rich or poor, is little to be envied, who at this supreme moment fails to bring forward his savings for the security of his country."**

Current News and Notes

Blenheim, Ont.

The Empire Flour Mills Company, Blenheim, Ont., plan the installation of considerable electrical equipment for operating their elevator and choppers.

Brantford, Ont.

The City Council of Brantford, Ont., will receive tenders until November 29 for a 40 h.p. 25 cycle induction motor for the sewage pumping station.

Charlottetown, P.E.I.

The City Council of Charlottetown, P.E.I., have under consideration the installation of an electric lighting system.

Delta, B.C.

The Municipal Council of Delta, B.C., have under consideration the installation of an electric pump in connection with the East Delta dyking and drainage system.

Greenwood, B.C.

The West Kootenay Power and Light Company plan extending their transmission line from Greenwood to Princeton and Copper Mountain, about 100 miles, to supply power to mines in that vicinity. A branch line to Penticton is also possible.

Halifax, N.S.

The strike of electrical workers in Halifax, N.S., which has affected about 55 men and apprentices for the past few months, was recently settled on the following basis: That work on Saturday afternoons in the summer months constitutes overtime; that the present schedule expire immediately and a new schedule take its place and remain in force until Dcember 31, 1918. The following is the new schedule of wages: Journeymen, 45 cents an hour; improver, 40 cents an hour; apprentice, third year, 15 cents an hour; apprentice, second year, 11 cents an hour; apprentice, first year, 6 cents an hour.

Hamilton, Ont.

A board of engineers consisting of Lieut.-Col. R. Leonard, Sir John Kennedy, W. F. Tye, L. A. Herdt, and Walter J. Francis, appointed by a committee of Hamilton, Ont., citizens to investigate the projected hydro-radial line from Port Credit to St. Catharines, Ont., have presented their report, which is against the proposal. They claim that it is not a public necessity, and that it could not be operated except at a yearly deficit of about $404,500.

Lethbridge, Alta.

The City Council of Lethbridge, Alta., propose the installation of a new turbo-generator and power plant equipment.

Maple, Ont.

It is announced that the village of Maple, Ont., will be served with hydro power by December 15. The transmission line from the sub-station at Woodbridge is already well under way.

Mariposa Township, Ont.

At a meeting of the Mariposa Township Council recently a resolution was passed to ask the Hydro-Electric Power Commission of Ontario for an estimate on power and light for the township.

Merlin, Ont.

A movement is on foot in Merlin, Ont., to secure hydro power for that village. Estimates are being prepared on the cost of extending a line from Chatham, Ont.

Mimico, Ont.

The sale of hydro debentures to the amount of $6,000 has been authorized by the Mimico Town Council.

Montreal, Que.

Hon. T. W. Crothers, Minister of Labor, has ordered the reinstatement of several employees in the office of the Great Northwestern Telegraph Company, Montreal, who were discharged after the recent strike because the company deemed their experience insufficient to justify the increased salaries now in force. The agreement between the company and the Department of Labor specified that all employees were to be taken back.

On a charge of making illegal gas and electric connections and stealing $12 worth of gas and electricity a man residing in Maisonneuve, Que., was recently sentenced to three months in jail or to pay fines and costs totalling $133.70.

Mr. M. A. Sammett, consulting engineer, Montreal, has been retained by the Bennett-Martin Asbestos Mines, Ltd., in connection with the electrical equipment for their mines and mill at Coleraine, near Thetford Mines. The equipment will consist of three 400 kva. 44,000-2,400-volt transformers, one 650 horse-power, one 275 h.p., and one 150 h.p. slip-ring type motors, with several smaller motors and transformers, as well as a switchboard for the control of the above equipment. The equipment will be of 3-phase, 30-cycle.

The Montreal Light, Heat, and Power Company have compiled an honor roll of employees with the overseas forces. The total is 117, but this does not comprise the whole list, as no trace has been kept of many names. The electrical department's employees total 22. Of the entire list, 17 have been killed, the electrical generating department having lost six in this way; 31 men have been wounded.

The Civic Investment and Industrial Company, operating the Montreal Light, Heat, and Power Company, and the Cedars Rapids Manufacturing and Power Company will apply to the Quebec Legislature to change their name.

Captain A. Solomon, of the Jewish Reinforcing Company, has been killed at the front. He died fighting against great odds, and his body, with those of ten men of his platoon, was not found for several weeks. The reports received in Montreal state that all had their throats cut. Captain Solomon was a former member of the firm of Solomon & Speilmann, electrical specialties, Montreal, and now known as the Speilman Agencies, Registered.

Lieut. J. H. Cardew, M.C., a graduate in the Faculty of Applied Science of McGill, has been killed at the front. He was electrical engineer on the Indian State Railways, and was English by birth.

Shareholders of the Shawinigan Water and Power Company have authorized an increase in the capital stock from fifteen to twenty million dollars. Mr. J. E. Aldred, the president, explained that it was not the intention at present to issue any of the stock; it was simply a question of giving the directors authority to issue when occasion required. He also referred to the prosperous condition of the company. In the early days of the hydro-electric business, consumers had to be educated, and radial concessions had to be given in order to sell the energy. Hydro electric energy was now even more dependable than steam. Consumers recognized this, and it was the intention of the Shawinigan company to get nearer what the other fellow was getting for his energy in the future.

Ottawa, Ont.

The Minister of Labor has appointed a board of conciliation to act in the dispute between the Ottawa Electric Railway Company and its employees. H. P. Hill, of Ottawa, is chairman. George F. Henderson, K.C., of Ottawa, will appear for the company and Fred Bancroft, of Toronto, is representing the men.

The International Joint Commission have issued a supplementary argument, under date May 15 17, 1917, in the matter of the "Measurement and Apportionment of the Waters of the St. Mary and Milk Rivers and Their Tributaries" in the United States and Canada.

Thornton, Ont.

A by-law authorizing an agreement with the Hydro-Electric Power Commission of Ontario was recently carried in Thornton, Ont.

Toronto, Ont.

In the death of Mr. W. R. Brock, on November 2, one of the most outstanding figures in the business life of Toronto has been removed. In addition to being the head of the W. R. Brock Company, he was identified as a director in a number of other concerns, including the Toronto Electric Light Company, the Electrical Development Company, the London Electric Company, and the Canadian General Electric Company.

Henry Patterson, assistant day operator at the Carlaw Avenue Hydro Sub-Station, Toronto, was electrocuted on November 2 when he accidentally touched a 13,000-volt wire.

Except in the down-town districts, the street lights in Toronto have been held off until 6 p.m. during the last week or so. The peak load is between 5 and 6.30, and every effort is being made to conserve the power for munition manufacturers. The city's requirements are in the neighborhood of 125,000 h.p., of which 45,000 is supplied by the Hydro-Electric Power Commission of Ontario.

We are advised that a factory for the manufacture of high-grade switching gear, imported from the United States up to the present time, will be started up in Toronto in the near future.

Weston, Ont.

The Water, Power, and Light Commission of Weston, Ont., have brought in the following report for the nine months ending September 30, 1917: Revenue, $19,968.35; expenditures, $16,914.74; gross surplus, $3,653.61; net surplus after deducting depreciation, $1,501.61.

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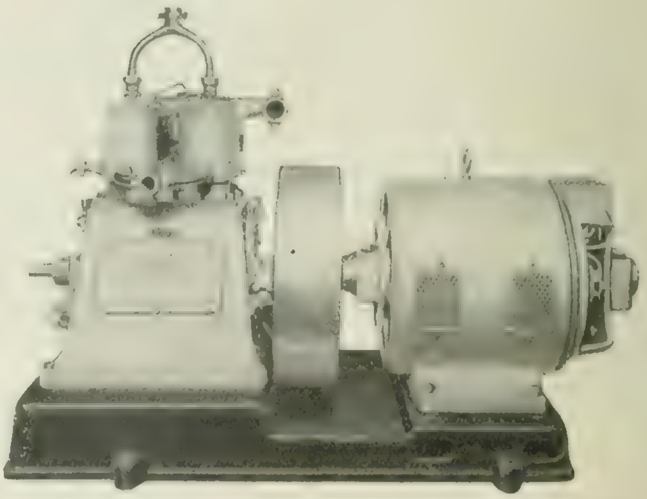

A 18 K.W. 110 Volt Plant. As installed at the Antitoxin Laboratory of the University of Toronto.

Electrical News
Generation, Transmission and Application of Electricity

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The Returned Soldier—Blessing or Menace?

"What the Dominion of Canada is doing for the returned soldier" was the subject of an informal talk on Friday, November 23, before the Electric Club of Toronto, by Professor H. E. Haultain, head of vocational training of returned soldiers in Ontario. The speaker referred to the fact that Mr. W. E. Segsworth, former chairman of the executive committee of the Joint Committee of Technical Organizations, had recently been appointed head of vocational training for the Dominion and took occasion to point out that in this appointment the government had recognized the fitness of a trained technical man for a position that is largely executive. He expressed the conviction that this established a precedent for which we have long waited and predicted that in future the pre-eminent qualifications of the engineer for positions of public trust now generally held by lawyers, doctors and professional politicians, would result in our profession taking a much larger part in the affairs of the nation.

Professor Haultain outlined briefly the problems that are being confronted in re-establishing the returned soldiers in civil life, or at least such percentage of them as are unable, through disabilities, to resume their former occupations. These men are now being carefully taken care of, utilizing, where possible, their former experience and training in civil life to fit them for a new occupation now more suitable to their changed capacities. Professor Haultain said experience was showing that we may reasonably expect that, under proper supervision, the returned soldier could be made into a more useful citizen than he was before enlistment. On the other hand, he pointed out forcibly that if these men are neglected and allowed to drift they will become a very serious menace to the country and a very unwholesome element in our national life. It rested with those of us who stayed at home to determine whether the returned soldier shall become a blessing or a curse.

For this reason the speaker urged the co-operation of all thinking men in solving the problems the country is now confronting for the first time in its history. The fact that there was no established precedent to guide us and no books to teach us, pointed to the engineer as the most likely source of usefulness in this work. He suggested the formation of committees to study the question and, if possible, make some constructive suggestions.

As yet the whole scheme is purely in the formative stage, though much has undoubtedly been accomplished, and Professor Haultain will welcome any intelligent, thoughtful ideas and give them every consideration.

The club will be addressed on Friday, November 30, by Professor A. P. Coleman, who will speak of his recent trip to South America.

The Future Place of the Engineer

Speaking before the Ottawa branch of the Canadian Society of Civil Engineers a few days ago, Mr. Fraser S. Keith, the general secretary, dwelt upon the necessity for educating the general public concerning the value of the work the trained engineer has done and is doing. Mr. Keith claims that the first step has been taken in that there has been an awakening within the profession itself as instanced by various events that have transpired within the past year or two; it remains now only to arouse those outside the profession.

There is no member of the engineering profession, whether civil, electrical, mechanical, chemical, mining or what not who will not raise both hands in favor of Mr. Keith's appeal. Every engineer, too, will plead guilty to his own laxity in "boosting" his profession. But, as has been pointed out so often, this very dislike of publicity or advertising in any form is an inherent part of the engineer's make-up. He has chosen this profession largely because he saw in it an opportunity to work quietly and unostentatiously. His outlook on life has been too ideal to be mercenary, and the world has accepted him on his own conditions and said: "All right, you stick to your ideal—good work—and we will stick to ours—good money."

Yes, the world has taken advantage of the engineer's high ideals and, not understanding them and, so, not valuing them, has neglected to rate them in dollars and cents. As a result, the brains of the man who designs the big bridge have less market value than the instinct of the salesman who supplies the bolts for the structure. And as long as the engineer accepts this as a satisfactory condition, just so long it will exist. Of course, it is going to be a terribly uphill fight, for the engineer, in general, has no great thirst for money. Even now it is his pride as much as anything that spurs him to demand better monetary recognition. How far is he prepared to go in his demands?

The engineering profession have two very definite precedents before them in the medical and legal professions. Time was when both of these were looked upon in much the same light as the general public now regards the engineer. Two factors have brought about the change— a standard was first established, and after that a proper value was set upon that standard. So, we believe, it must be in our own profession. An "engineer" must mean something more than the "expert," who receives his title from the newspaper re-better and, after that, there must be a mutual understanding and recognition among engineers themselves of the value of their services.

Another phase of the engineer's future which Mr. Keith touched upon, and which we have repeatedly advocated, is that he must interest himself in the government of his country. Mr. Keith says: "The lawyer and the politician have admittedly failed to solve the industrial relations of man to man and the relation between capital and labor." How could it be otherwise? The actions of lawyers and doctors are regulated by precedent. Their education consists largely in a study of past experiences. The education of an engineer, on the contrary, consists in an examination of general principles — his after success consists in their application. Every problem in engineering is, in the main, a new one, and so there is developed that attitude of mind, that aptitude and quality of mind, that makes the engineer the logical choice for the solution of most of those problems for which there is no precedent. Such a one is the relation of labor and capital. Now that our governments are showing signs of recognizing the principle of regulation and control "for the good of the state," no better men could be chosen for the councils of the state than men trained in engineering experience.

But it is easy to talk of what the engineer could do. The first problem is "How can we get engineers into Parliament?" Can our engineers solve it?

I. E. E. President Advocates "Education" of Workman and Public

Apropos of the legitimate activities of engineering socities are the following extracts from the inaugural address of the president of the British Institution of Electrical Engineers, just published. It is gratifying to know that this time-honored organization sees in the "public" and the "workman" a fruitful field of educational work and at the same time considers it in no way "infra dig" for a highly technical society to undertake the work. Perhaps the war which has already shattered so many of old England's traditions is also responsible for this one. However, whatever the cause may be, any movement that tends to raise the standard and the ideal of the workman and to bring him and the general public into a state where they can appreciate and value more nearly at its true worth the significance of engineering in the national life is surely in the right direction. The following extracts are from a most excellent address:—

Workmen

I should like to see something done with a view to interesting the enormous army of men not qualified to become members in any grade of the Institution, but on whom much of the welfare of the industry depends. I refer to the workmen class. It should be possible to awaken in these men, many of whom are exceedingly intelligent, a desire for a better knowledge of the principles underlying their work. We have seen attempts made by individual firms to promote such interest by the holding of examinations and the offering of prizes; surely if an individual firm can create interest in this manner it should be possible for the Institution to do far better. The opportunity could be utilized for taking up economic questions with a view not only to educating workmen in the scientific principles of the work on which they are engaged, but also in the economic questions which are vital to the success of the industry.

The Institution might with advantage come out of its shell and cater for the education of the general public in electrical matters. Popular lectures on the lines so successfully followed by the Society of Arts and the Royal Institution would do much to spread an elementary knowledge of electrical subjects and to make the public realize the advantages of electrical appliances. Lectures which gave solid facts to individuals of ordinary common sense would, I believe, do far more to promote the objects sought by so-called "publicity campaigns" than any amount of exaggerated statements, or of posters and illustrations, imagined by their authors to be humorous or arresting. Even children might be catered for by suitable lectures, say at Christmas time, accompanied by demonstrations of electrical toys and simple educational apparatus.

Permanent Exhibition

This branch of the work might be supplemented by a carefully organized permanent exhibition of electrical appliances, these being constantly changed, and demonstrations of new apparatus arranged for. It ought to be a well understood thing that if any new useful electrical invention is brought out it can be seen at the Institution as a matter of course, and an explanation of its action be forthcoming.

Re-establishing the Soldier in Civil Life

How Canada is meeting the problems attendant on the returned wounded soldiers was explained by Prof. S. B. Kidner, vocational secretary, Military Hospitals Commission, Ottawa, at the Montreal Electrical Luncheon on November 21. The immediate problem, he said, was to get back the wounded into civil life, while later they would have to solve the more serious problems of dealing with the men now at the front. Pensions, however generous, were not enough to pay the men who were fighting for the country. Canada must see that these men were given opportunities to take their part in the life of the community. The problems were difficult to solve because of the routine training of the men, their lives now being ordered by rule. In the case of the wounded, the difficulty has increased by the very nature of things.

In giving details of the steps taken by the government to meet the situation, Prof. Kidner referred to the vocational re-education scheme, and stated that investigation showed that only a very small proportion of the returned soldiers were unfit to go back to business life. The government had established throughout Canada fifty institutions with schools or with schools attached. In these institutions a large variety of trades were being taught, and wherever possible outdoor work was undertaken. In several of the prairie schools the use of farm machinery was taught. There were 3,500 men attending classes in the various schools, while the total number under the care of the Hospitals Commission was 10,200, this number having increased from 1,305 in March, 1916.

The percentage of those who were so seriously disabled that they would have to be re-educated for fresh occupations was from 8 to 10 per cent. The total number of the blind was 32, while the men who had lost arms and legs was 917, and of these 632 had lost their legs. The tubercular cases totalled 1,486, some being men who had not reached the front. The cases of insane were much smaller than was generally thought, the percentage not exceeding that in ordinary civil life.

Some of the re-educational work was done in the schools, and arrangements were also being made with industrial establishments by which men would be trained there. This, of course, involved such problems as workmen's compensation and the rate of wages to be paid. In concluding Prof. Kidner spoke of the marked difference found, in dealing with men, between those who had received a technical training and the men who were previously engaged in blind alley occupations. The former were self-reliant, while the latter were always worrying as to their future. Canada would have to consider more seriously this question of the technical education of her people.

Extensions Under Way at Cedars Plant

Power House Work Well Advanced—Units 13 and 14 Will Bring Present Capacity to 120,000 h.p.—Units 11, 12 and 15 to 18 Later

By C. H. Covey*

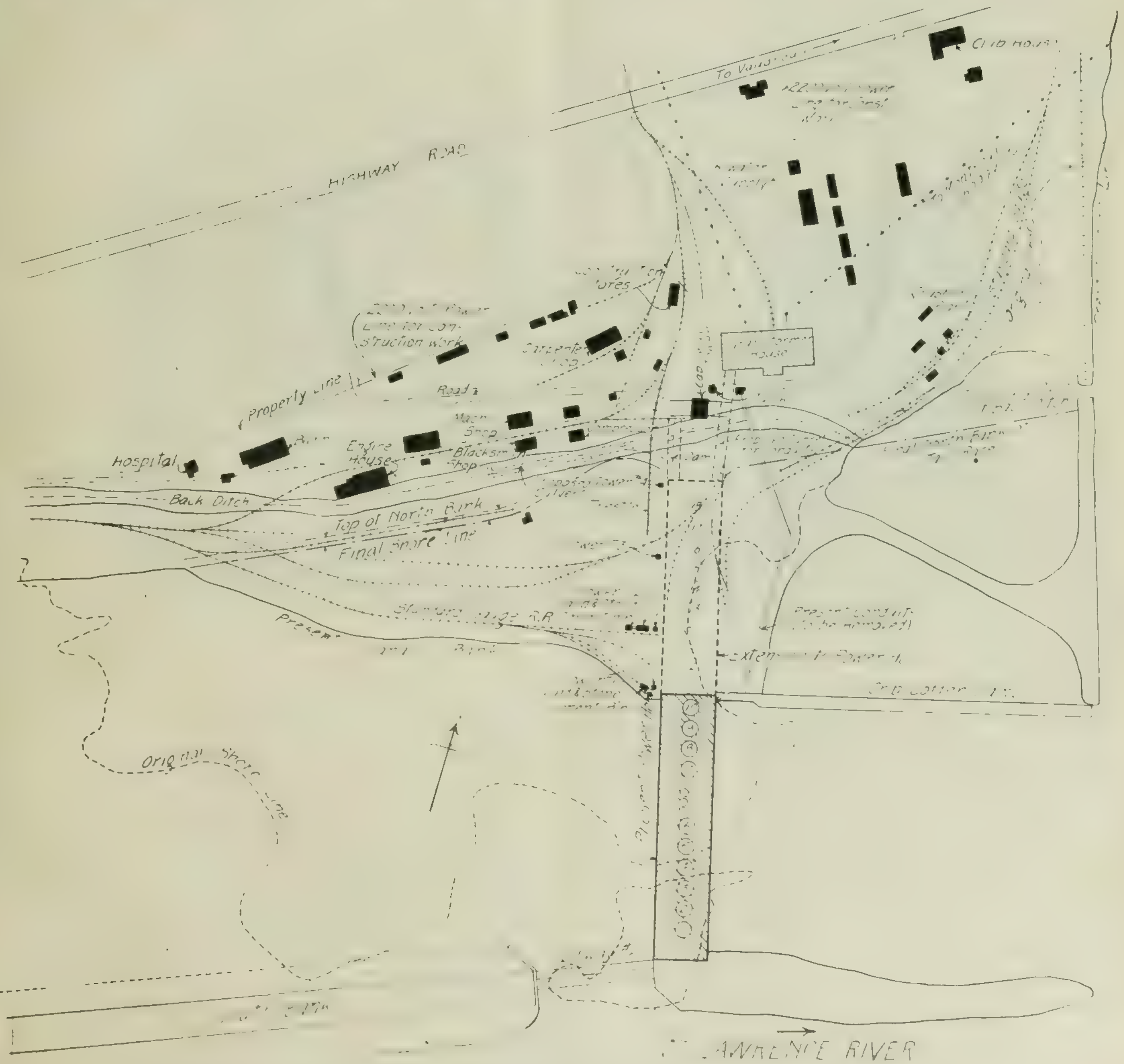
The second hydro-electric development at Cedars, P.Q. consists of an extension of the present power-house approximately 500 feet, excavation of tailrace, and excavation of all headrace that can be done in the dry. The above involves the placing of approximately 65,000 yards of concrete, excavation of 100,000 yards of rock and 200,000 yards of fearth.

General Layout of Plant

The concrete is placed by means of concrete towers and chutes, the towers being placed at intervals of approximately 160 feet apart and 10 feet from the upstream face of the power-house. Two Rex mixers of 35 cubic feet capacity are used in connection with the towers; Insley 32-inch chutes are employed for placing the concrete. These towers are built in connection with a trestle, which is constructed parallel to the upstream face of the power-house. Stone, sand-bins, and small cement storage houses are constructed in the trestle at each tower to furnish materials to the mixer. The materials are handled to the mixer by means of 6-yard cars and 25-ton American locomotives.

Stone Crushing Plant

The stone crusher plant consists of one 42-inch x 36-inch Farrel-Bacon style "B" crusher built by the Jenckes Machine Company, Sherbrooke, Que.; also one No. 7½ Traylor crusher,



General plan showing location of present power house and its extension to accommodate full eighteen units.

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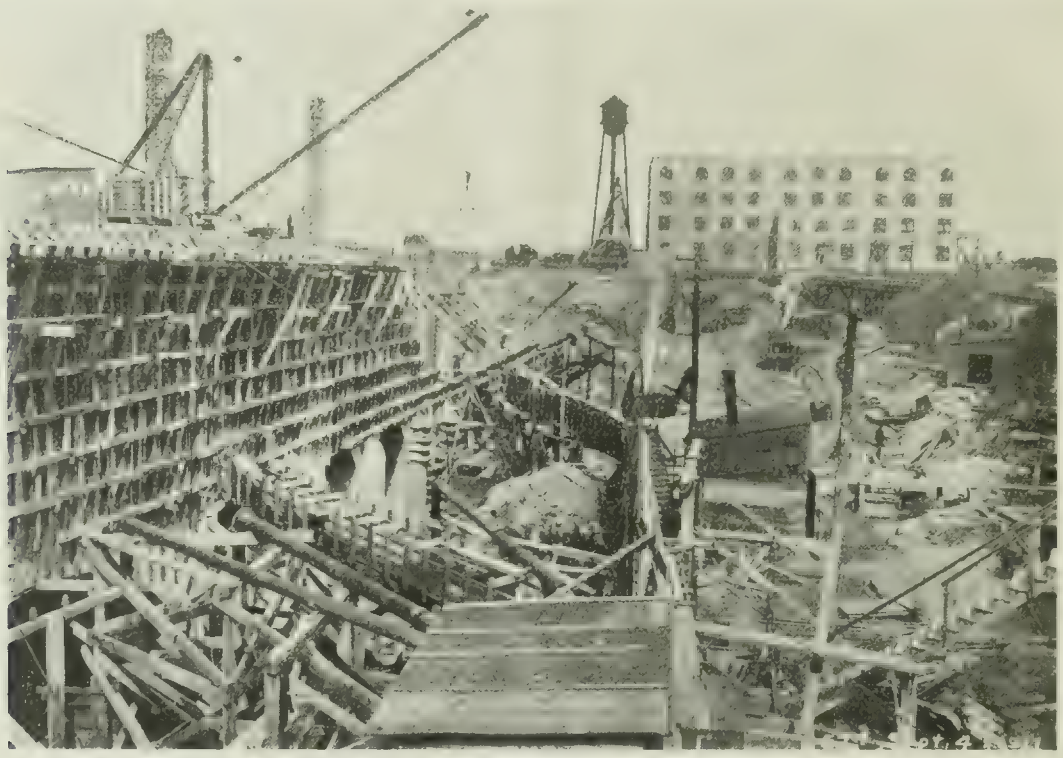
*Fraser, Brace & Co., supervising engineers.

gyratory type, and one No. 5 Traylor crusher, gyratory type used as an auxiliary. The stone is fed into the 42 in. x 36 in. crusher in sizes as it comes from either hand or shovel excavation. After passing through this crusher it is taken to the No. 7 crusher by a 6-ply 26-in. rubber covered belt conveyor, inclined at a slope of about 34 in. on 10 ft. The stone passes through the No. 7 crusher and is then elevated to the screens, all rejections then passing through the No. 5 auxiliary crusher and thence to the stone pile. From the stone pile the rock is handled to a loading bin by a Beatty hoisting engine and a 15-ton stiff-legged derrick, a ¾-yard Lidgerwood clamshell bucket being used on the derrick. It is thence taken, as above noted, in cars over the trestle to the mixer plant. It might here be noted that the crusher plant is a result of the remodeling of the old crusher plant used on the first development, and the layout is possibly not as economical as might be constructed in case a new plant was to be built.

The rock excavation at the power-house site is being done by a Marion steam shovel, model 31, with a ¾-yard bucket, and which was purchased specially for this purpose. The earth and rock excavation in the tailrace is being done by two model 70C Bucyrus steam shovels, each having 2½-yard buckets; 25-ton American locomotives are used exclusively. The compressed air drilling, etc., is furnished by two Canadian Ingersoll-Rand compressors, each having a capacity of 1,11[illegible] cubic feet of free air per minute.



General view of Cedars construction work, looking north toward transformer house.

Cableway Is Special Feature

A cableway has been constructed, with a moveable tower about 150 feet from the end of the finished power-house, with a cable which extends from this tower to the top of the present power-house and anchored to a deadman beyond the far end of the old power-house. The cableway is of a radial type, and was built on the ground out of plant on hand, most of which had been used on the earlier Cedars construction. The cable is carried across the present house by means of trestle bents, which allow the cable to move back and forth [illegible] to the end of the power-house nearest the extension the cable is supported on a truck which moves back and forth on a track as the tower moves back and forth.

The cableway can be moved so that it will cover practically the whole area of concrete construction, the tower being moved on tracks by means of a single-drum 15 h.p. hoisting engine, attached to an endless ⅝-in. cable, which is reaved through two sets of double blocks and run forward to an anchorage. The tower can be moved a maximum distance of 140 feet. The total span of the cableway from centre of tower to the extreme end of the present power-house is approximately 1,300 feet, but only 700 feet is in the clear, as the remainder passes over the power-house already constructed. The tower is 64 feet high, constructed of timbers, 8 in. x 16 in. British Columbia fir for the larger members, with 8 in. x 10 in. and 8 in. x 8 in. struts, and 3 in. x 9 in. tie braces. The main cable is plow-steel wire strands, and is 2¼ in. in diameter. This is the same cable used on the first development for the dumping cableway. For traversing the carriage a ⅝ in. cable is used, and the hoisting cable is also ⅝ in. The engine used on load line is 30 h.p. That on travelling line is 15 h.p., and is the same one as used on the traveler which was employed in placing concrete for the original work at Cedars. The trucks, which are standard gauge, also came off this traveller. The cableway is only used for handling materials, forms, etc., and is not used to handle any excavation or concrete.

Delivery of Materials

Materials which come in carload lots are consigned to Coteau Junction, and come thence to the job via Soulanges Canal, on the company's car ferry. The cement is delivered to the job by barges, through the Soulanges Canal to the company's wharf in the Provincial Light, Heat, and Power Company's headrace, and is unloaded by means of a gooseneck conveyor, which can be lowered into the barges. The cement is loaded directly onto the conveyor, which carries it into the storage warehouse nearby. This is the same unloader as used on the first development. Coal has been delivered to the job by way of cars, which came to Coteau Junction and were handled over the car ferry to the job. On the first development, however, the coal was delivered to the job by barge, and unloaded by means of a derrick and clamshell bucket, which loaded the coal into the hoppers, which in turn dumped the coal into a Hunt automatic dumping car, which carried it to the pile.

Unwatering the Site

A cofferdam has been constructed for unwatering the tailrace for the second development. This cofferdam was built extending from the end of the old cofferdam, about 150 feet from the power-house, to the lower end of the tailrace, which connected with part of the coffer left from the original development. It was constructed on the bottom of the tailrace of the first development, which had previously been excavated wide enough to permit this. This cofferdam, after its completion, cut off a considerable portion of the water which was encountered in the bottom of the power-house excavation during the earlier stages of the work this spring. The cofferdam is approximately 800 feet long and about 25 feet high.

Personnel

The work is being done by the Civic Investment and Industrial Company, which operates the Montreal Light, Heat and Power Company, the Cedars Rapids Manufacturing and Power Company, and other companies. R. M. Wilson, of Montreal, is the chief electrical engineer. G. P. Hawley is resident engineer. Fraser, Brace & Co., of Montreal and New York, have been retained as supervising engineers. James H. Brace is the firm's resident representative, and the Fraser, Brace & Co.'s organization is directly employed by the Civic Investment and Industrial Company to do the work.

Toronto Section A.I.E.E.

There is not, at first sight, the material for an extremely interesting lecture in either of the subjects of current transformers, demand meters or relays; nevertheless, the papers presented at the last local meeting of the A. I. E. E. drew an attendance of some sixty members of the Toronto Section. Quite a new light was thrown on the subject of testing current transformers, by Mr. Harry Baker, in describing the test ring method developed by himself, and his mastery of the subject enabled him to meet and defeat his critics without difficulty. None the less the discussion on this paper and the succeeding one by Mr. P. A. Borden was quite an active one. In reference to this matter of maximum demand, we are strongly of Mr. Borden's opinion that it is high time some standard definition were arrived at for the quantity (to say nothing of load factor, power factor and several other terms in common use). The various forms of protective relay, together with their scope, their limitations and their operation were described in very lucid fashion by Mr. C. W. Baker, brother of the first speaker, and the discussion on his paper terminated at 10.45 p.m., after a very instructive and entertaining meeting.

A large number of new applications for membership in the American Institute of Electrical Engineers is now being received which demonstrates that our young engineers appreciate the necessity of maintaining our technical efficiency at the highest point; never indeed was the necessity greater. Mr. A. B. Cooper is the chairman of the local committee on membership and will be pleased to give all possible information about the Institute in response to any inquiries sent to him at 212 King Street West, Toronto.

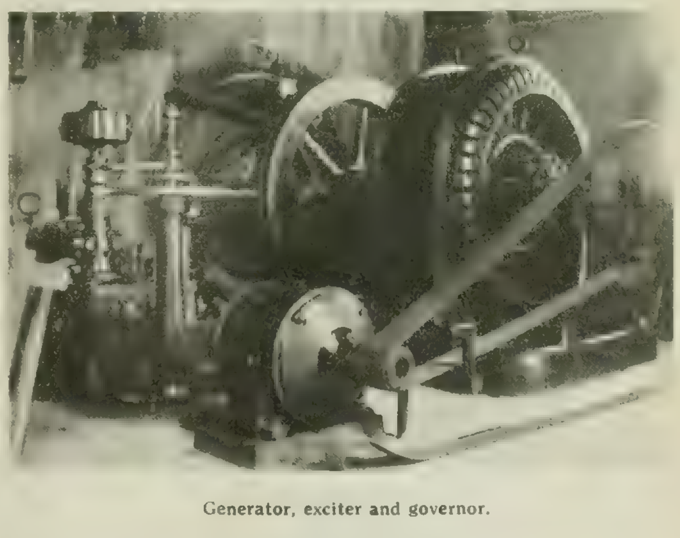
More Electrification for C. M. & St. P.

The Chicago, Milwaukee, and St. Paul Railway placed orders on October 29 for the substation equipment of their 217-mile Othello, Seattle, and Tacoma division, and also for seventeen locomotives to be used on either their first or second electrifications, as may be hereafter determined. To hasten delivery dates, the orders were divided between the Westinghouse and General Electric Companies as follows: Westinghouse, ten locomotives and three substations; General Electric Company, seven locomotives and five substations. Each substation will require one or more 2,000 kw., 3,000-volt, motor-generator set.

Unique Plant at Durham

The Durham Furniture Company, Durham, Ont., operate their plant entirely by electric motors, current for which is generated at their own power plant, about four miles distant, on the Rocky Saugeen River. The two illustrations show the dam and power-house and an interior view, with generator, exciter, and regulator. Individual motors are used wherever possible throughout the factory, but in the case of some of the lighter machines, such as the band-saw and spindle-carvers, the group drive has been adopted. Altogether there are 58 motors in use, some direct connected, some driving machines by means of belts.

Dam and power house—Durham Furniture Company.



Generator, exciter and governor.

Special facilities are announced officially for week-end cable letters at cheap rates to or from Canadian soldiers, sailors and nurses on overseas service. The letters must be of a social character and can be cabled at 5 cents a word to or from Ontario.

Electric Railways

The Bow Trolley Collector

By Ernest V. Pannell

With increase in the magnitude of electric railway projects the problem of collecting current from the overhead trolley wire becomes a serious one. Whereas the single-truck street trolley car common until recent years, with its two 30-horse-power motors, seldom required a greater input than 150 amperes, one of the locomotives recently delivered to the Chicago, Milwaukee, and St. Paul Railroad, for service on their mountain divisions, draws 1,000 amperes from the trolley wire when accelerating. Such heavy currents are far beyond the scope of the ordinary grooved trolley wheel and demand a special form of collector. Of this, two forms have been developed—the bow and the roller—the one giving a sliding and the latter a rolling contact on the trolley wire. Either form is kept in contact with the wire by means of a swinging arm or a pantagraph; and in Fig. 1, illustrating a typical pantagraph in outline, the position marked "contact surface" may be occupied by either a bow or a roller.

The roller trolley is becoming increasingly popular in electric railway work in America, and is used on various divisions of the Southern Pacific Railroad; also upon the Butte, Anaconda, and Pacific Railroad and the Mount Royal Tunnel, in Montreal, among other installations. A typical form of roller consists of a steel tube 5 in. diameter and ¼ in. thick. It is about 36 in. long and mounted upon ball bearing at either end. As a general rule, the wire is strung in a zig-zag, from side to side, so that the whole contact face of the collector is utilized, and there is little risk of grooving.

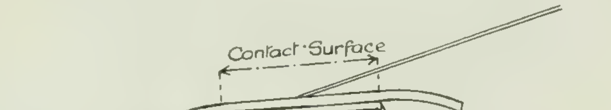


Fig. 1 -Diagram of typical pantagraph collector.

In the case of the bow-collector the roller is replaced by a strip of soft metal, which is pressed upwards against the trolley wire, thus making a sliding contact. The material used for the strip is sometimes mild steel or copper, but the most usual metal is a light aluminium alloy, which is softer than the trolley copper but hard enough not to wear into grooves. The main requirements of a collector of whatever form are:

(a) Good and uniform contact.
(b) Mechanical simplicity.
(c) Lightness.
(d) Absence of wear on wire.
(e) Durability.

Excellent contact is maintained by both the roller and the bow, but at moderate speeds the former has the greater capacity. Over 1,000 amperes can be collected from a single trolley wire, whereas the sliding bow reaches its limit at about 100 amperes. This factor is influenced by the material of the collector; pure aluminium is found to be decidedly inferior to a 6 per cent. copper alloy, and this latter is almost universally employed. The alloy does not oxidize as readily as the pure metal, consequently there is more uniform contact. At the same time there is no tendency to rust as with the steel roller. In regard to mechanical simplicity, the bow is somewhat superior to the roller on account of the absence of bearings. It is naturally much more easily replaced than is the roller. The chief asset of the bow is, however, its lightness, particularly for high speeds. When the elevation of the trolley wire is changing, the collector must also rise and fall, and, unless its inertia be very small, it will tend to leave the wire at times, thus drawing an arc and at the same time reproducing a hammering effect on the wire. Disregarding the weight of the pantagraph mechanism, which is common to both kinds of collector, the average roller weighs thirty pounds, whilst the bow weighs about six. Over and above the pressure necessary to support the weight of the collector, the usual pressure on the trolley wire is about thirty-five pounds for the roller and from five to ten pounds for the aluminium bow. It will be gathered from this that the bow is the ideal collector for high speeds. The only electric railway tests which resulted in speeds of over 100 miles per hour were made in Europe with aluminium bows. At 1,500 volts twin aluminium collectors drawing 100 amperes from the line each would supply a

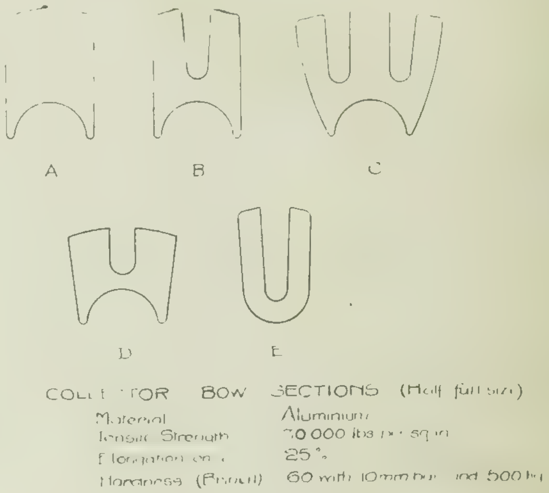


Fig. 2—The bow trolley collector.

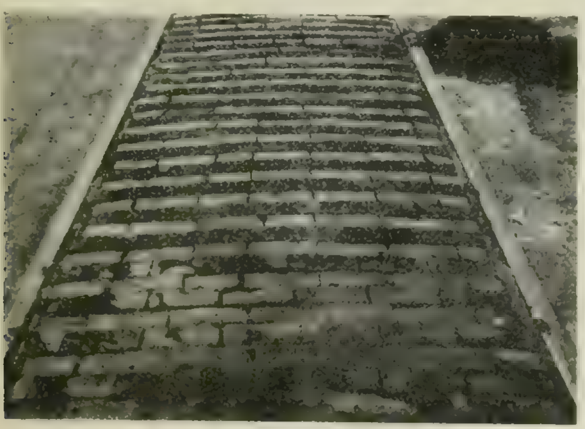
motor car or locomotive of 400 h.p. covering the requirements of all but the heaviest service. For very heavy slow-speed operation, however, the roller trolley collecting right up to the limiting capacity of the line wire has all the advantages. If properly adjusted neither type of collector wears the trolley wire unduly, but the bow has the advantage of supplying lubricant direct to the point of contact. As will be seen in Fig. 2, the sections used are designed with a groove running their whole length. This groove is packed with a mixture of grease and graphite, which effectually minimizes the abrasion of the wire and improves the contact.

The bow-collector is almost universal in Europe for street, interurban, and heavy railway service, the trolley wheel or roller being very seldom seen. The pattern shown at (D), Fig. 2, is used on an important single-phase suburban electric railway in England. This type of bow collects about 100 amps. on a service involving frequent and rapid accelerations, and yields about 3,500 miles before being renewed. One of these bows, four feet in length, weighs five pounds, and costs about $2.50. On the basis of four collectors to a train, therefore, the cost is 1/3 per train mile, not allowing for the scrap value of the discarded strip. Several installations give much greater mileage than this, 10,000 miles being not unusual for lighter service. Fig. 2 (C) shows the section of the collector which is employed on the heaviest European electric locomotives yet constructed.—those which are operating through the Loetschberg Tunnel, in Switzerland. There are two collectors to a 2,000 h.p. locomotive, and at a trolley pressure of 15,000 volts the current per bow would figure out at 50 amperes. Owing to the low power factor at starting, however, the actual current for acceleration is much greater than this.

Combining Brick or Granite Block with Wood Paving Block

The view herewith shows the novel combination of brick and creosoted wood paving block laid in alternate rows in the tracks of the Toledo Railways and Light Company, on Main Street, Toledo, Ohio., and described in Municipal Engineering. This construction is attracting the attention of street railway engineers in all parts of the country.

On this work a 6-in. 100-pound steel rail was used. A 2-in. header block was laid under the ball of the rail, providing for the tread of the flange of the wheels. A detail of the construction is as follows:



Alternate rows of wood block and brick.

Alternate rows of Kreolite end lug wood paving blocks and ordinary, second-hand paving bricks were used, with the wood blocks laid about ⅛ in. higher than the adjoining rows of bricks. The blocks were treated with but 6 pounds of creosote per cubic foot of timber by the Rueping process, as it is only desirable to prevent the decay of the wood. Owing to the presence of the lugs the creosoted wood block will expand without buckling, keeping the construction permanently smooth, tight, and compact. The interstices between the individual units comprising this pavement were filled with a Kreolite bituminous filler. The bricks used had already seen five years of service in the track, and quite a number were shattered and broken.

This very interesting piece of track-work has now been completed about six months, and the traffic has ironed it into smooth, compact, homogenous-appearing wearing surface.

This method of construction, it is claimed, not only gives a greater stability to street car track pavement, but also prevents loose joints and loose rails, as the wood will continually swell, due to the absorption of moisture, through direct contact or through the humidity of the atmosphere, and thus keep the pavement solid and tight at all seasons of the year.

The wood block rows are laid a little higher than the rows of brick, so that the annealing effects of the traffic will weld the wood over the edges, preventing the cobbling of the bricks.

It is obvious that, in the case of alternate rows of bricks and Kreolite end lug wood blocks, the first cost of a creosoted wood block street pavement would be greatly reduced. At the same time many of the advantages of both kinds of paving material would be retained, with none of their objectionable features, it is claimed. A brick pavement constructed with alternate rows of wood blocks would be transformed into a quiet pavement, while an ordinary rectangular creosoted wood block pavement would be transformed into a non-slippery, non-bleeding, non-bulging, and much lower-priced pavement.

Railway & Power Engineering Corporation

An announcement of importance has just been made regarding the formation of the Railway and Power Engineering Corporation, Ltd., which includes the various departments necessary for the equipping of railway, light, power mining, and industrial plants. This corporation has well recognized business connections with leading manufacturers, and is in an excellent position to secure the best of equipment and supplies for its customers. The organization consists of competent and thoroughly practical engineers and salesmen, capable of demonstrating the value and use of all their lines of equipment and supplies, and, in addition, of giving complete and valuable advice. The president of the company is one of the best-known figures in Canadian engineering circles—Mr. Theo. Malm, late of the Canadian Northern Railway System.

Under the present abnormal conditions it is often impossible to secure the customer's material in time to meet his purpose, and an important feature of the announcement just made by this corporation is that they have opened, temporarily, a "used equipment department," where all equipment sold is subject to the customer's inspection. The corporation, however, will give all possible advice and assistance in bringing the equipment to its highest possible efficiency without any added cost to the customer.

A more complete outline of the functions of the Railway and Power Engineering Corporation, Ltd., will be given in their own announcement in our December 15 issue. In the meantime they have opened offices at 202 C.P.R. Building, Toronto.

Mr. J. E. Dobson, late Scottish representative of Bruce Peebles & Co., Ltd., Edinburgh, has been appointed London office manager to the company, in place of the late Mr. R. W. Gauntlett, and has now taken up his new duties at Hastings House, Norfolk Street, Strand. We feel sure that Mr. Dobson's many friends, both in Scotland and elsewhere, will wish him every success in his new appointment

Personals

Mr. William J. Lynch, whose appointment as general manager of the Quebec Railway, Light, Heat, and Power Company was announced in the Electrical News some time ago, is an example of the fact that the most important executive positions do not always gravitate to the men of most years, for he is only 35 years old. His early education was acquired at the Commercial Academy Christian Brothers' School, Quebec, and he entered the employ of the Montmorency Electric Power Company, as office clerk, in 1897, and was appointed cashier in 1900, at the time of the amalgamation of the Montmorency Electric Power Company with the Quebec, Montmorency, and Charlevoix Railway and Quebec District Railway. In 1905 he was appointed accountant and in 1907 treasurer. In 1909, at the time of the merging of the public utilities in the city of Quebec and district, now operated by the Quebec Railway Company, he was appointed treasurer and comptroller, which position he occupied until the time of his promotion to succeed the late Mr. H. G. Matthews as general manager. Mr. Lynch is a man of broad interests and wide experience, and, under his competent direction, it is confidently anticipated that the future operation and expansion of the Quebec Railway, Light, Heat and Power Company will be most gratifying.

Mr. W. J. Lynch.

Mr. E. V. Caton, chief engineer city of Winnipeg light and power department, has been elected a member of the Canadian Society of Civil Engineers

Mr. H. E. Randall, Jr., Montreal, in charge of the sales department in an engineering capacity of the Shawinigan Water and Power Company, has been elected a junior member of the Canadian Society of Civil Engineers.

Mr. D. J. Beatty who was connected with the Northern Electric Company for several years and was head of the publicity department, has joined the 79th Battery. Mr. H. S Stevenson, Mr. Beatty's assistant, is now in charge of the department.

Mr. J. W. White has been appointed manager of the power and railway divisions of the Detroit office of the Westinghouse Electric & Mfg. Company. Mr. White was formerly connected with the Pittsburgh office of this company, subsequently becoming associated with the Allis-Chalmers Company. He has now returned to the Westinghouse Company, assuming the position above noted.

Mr. M. B. Hastings, secretary of A. H. Winter Joyner, Limited, Toronto, who left Canada last spring as lieutenant in the 67th Battery, Canadian Field Artillery, recently arrived in France and reports that he is enjoying the life.

Mr. A. E. B. Hill, C.E., for ten years with the B. C. E. R Company, Vancouver, retired recently. Members of the staff united in presenting him with a solid silver loving cup, the presentation being made by Manager Geo. Kidd, who voiced the esteem of the officials and employees of the company.

Mr. I. H. Steven, lately resident electrical engineer at the Tough Oaks Mine, which position he has held since his return from France in August, 1916, after spending two years on active service on telephone work with the Canadian Artillery, has become associated with Mr. W. A. Buchanan. Canadian representative of the Mechanical Appliances Company, Milwaukee. Mr. Steven will have charge of the electrical sales end of the business and is specializing for the present on Watson motors, 1/8 to 75 h.p., and Sirocco fans. Mr. Buchanan's office is located at 526 Traders Bank Building, Toronto.

B C. E. R. Co. Are Inconsiderate

Lady, in New Westminster interurban station: "Why have you no looking-glass in this station? I never heard of a railway station without a mirror before. The way these jitneys muss up your hair is fierce."

Trade Publications

The Hunchman—Volume IV., Number 4, distributed by the Canadian General Electric Company; a very attractive little booklet published in the interests of better illumination and dealing particularly with Ivanhoe metal reflectors and Regent illuminating glassware.

C. G. E. Publications—Bulletin 41021, R.F. adjustable speed motors; bulletin 46201A, single-phase watthour meters; bulletin 46010, curve-drawing instruments for alternating and direct-current circuits; bulletin 46017, direct-current instruments.

Projectors and Reflectors—The Crouse-Hinds Company of Canada, Limited, are distributing catalogue No. 303, dated October 15, 1917, describing and illustrating various types of Imperial flood light projectors and reflectors developed to date. Tables, diagrams, and prices are also given.

Insulating Materials—Chicago Mica Company, Valparaiso, Ind., is distributing catalogue No. 21, on "Champion" insulating materials. It deals particularly with Champion oiled cambric and Champion tapes. The cambric is made in thicknesses from 5 to 15 mils, and is furnished in rolls of 25, 50, and 100 square yards. The tapes are cut bias or straight and are obtainable in widths from three-eighths to three inches. These oiled fabrics have very high insulating qualities.

Pole Line Hardware—The Hubbard Catalogue comprises a complete list of Hubbard pile line hardware and Peirce construction specialties, under the following sections:: Pole work material; guying material; cross arms, pins, and fittings; high tension arms and fixtures; pole top pins and fixtures; secondary distribution fixtures; universal lighting arrestors; transformer mounting material; Peirce service wire brackets, hammer drills, and expansion bolts; street lamp suspension devices; electric railway material; cable suspension material; underground cable material; telephone and telegraph wiring; line and track construction tools; Bates expanded steel poles. The Hubbard and Peirce lines are being manufactured in Canada by the Acme Stamping and Tool Works, Hamilton. Two hundred and sixty pages, splendidly illustrated.

The Dealer and Contractor

The Ills of the Electric Contracting Industry—Best Solved by Co-ordinating the Various Interests—A New Use for the Wheatstone Bridge

In an address before the eleventh annual convention of the National Electrical Contractors' Association, held in New Orleans, Mr. William L. Goodwin spoke on the "Ills of the Industry." Mr. Goodwin was formerly general manager of the Pacific States Electric Company, a California jobbing house, but is now on the staff of the General Electric Company, and it is safe to say that his plan of reorganization was the chief topic of conversation and discussion at the convention.

It was not so much that Mr. Goodwin said anything new as that he said it in a new way. He put it a little more concisely and particularly he caught the attention of the delegates by his method of illustration. In a word, the new plan —the Goodwin plan, as it came to be called—is nothing more than a closer co-ordination of all the various elements in the electrical trade—manufacturer, jobber, dealer, contractor—and the novelty in method of presentation consisted in likening these various elements to the arms in a Wheatstone bridge. It was doubtless this idea of "balance," the basic idea of the bridge, that caught the public fancy.

For the benefit of those of us who may have almost forgotten what a wheatstone bridge is, let us recall that it is a simple laboratory instrument for determining the value of any unknown resistance by balancing it against a known resistance, the condition of balance being indicated by means of a galvanometer or any very sensitive current measuring instrument. The operation of the instrument involves the constant adjustment of the resistances in its four arms. Herein lies its similarity to the electrical trade. The smooth running of this industry demands the continuous adjustment and tuning of the four elements—manufacturer, jobber, dealer, and contractor.

Mr. Goodwin outlined his plan at great length, and space does not permit us to reproduce his explanation in full. We are printing, however, certain sections of his address, in which we have endeavored to include the most important statements and arguments. The speaker's realistic diagram is also reproduced:

Mr. Goodwin's Address

In approaching this whole question I want it to be understood that I have endeavored to confine my study and recommendations to basic principles, something which is not generally understood by the membership of this and other organizations. Having to do with these basic principles, I want to add, further, that there is nothing original in what I am going to present to you to-day, except, possibly, this wheatstone bridge principle of electrical merchandising. Everything else is the result of the collective thought, study, and experience of the thoughtful men of the industry. My part has simply been to uncover these facts, tabulate them, and present them in understandable form.

To get down to the real question of the ills of our industry we must constantly have in mind that in order to provide a remedy we must first determine the cause. Most of our effort in the past has been to solve the problems before us, without any consideration of the basic cause of the trouble. It is useless to discuss, for instance, the question of organization, the question of merchandising, and to criticize the methods proposed unless those criticizing are in possession of basic facts—and what I mean by basic facts are questions that have never been discussed in our various trade organizations.

I spent a great deal of time recently in a meeting of the electrical wholesalers, and there I found that the discussion at the particular meeting was along the lines of internal investigations of cost overhead, packages, and distribution; that much time and money was being spent by that organization in the solution of that question; whereas, as a matter of fact, it occurred to me immediately that the basic cause was from without, and the men of that organization have been discussing that problem for probably ten years, and even now have not realized that the basic cause is outside of their own organization. No effort whatever has been made to approach the subject from that standpoint. That is what I refer to when I say that organizations should only deal with and discuss basic facts.

Another ill of the industry has [illegible]

All Together!

Will You?

Make No. 51

at the

Anniversary Dinner

of the

Toronto Electrical Contractors' Association

at the

Carls-Rite, December 6th, 1917

7.30 SHARP

part of existing organizations to solve these many problems by treatment only within their own organizations. It is impossible, in an industry such as ours, made up of at least four commercial factors, to solve any of the more important problems, except first by discussion within each organization and conclusions as to basic facts, and then, by co-ordination, bringing the other organizations together to discuss the problems jointly, by all interested. Until that one principle is recognized the solution is not here.

Present National Organization

Another great ill that I hope will soon be cast aside, but which is a very live question at this time, is the form of your present National Contractors' Association, Mr. Chairman. The nature of your association does not permit of the treatment of the problems before you to such a degree that you have been able to attract the great numbers of men in the contractor-dealer branch of the industry. This is evidenced by the fact that in the many years that this organization has been operated you have now a membership of approximately twelve hundred. That suggests a fundamental fault right there. What the fault is, or was, is immaterial. I classify it as a fundamental fault. That is not with the idea of criticizing the men who have worked so honestly and faithfully in behalf of the interests of the organization, but it is simply an evidence of the many difficulties we have had in struggling with our problems—because it is also evident in all other organizations. Therefore, in approaching the question of organization it was immaterial to me how the various clauses of the constitution were set in order, or what the objects of the organization were to be; but to provide a basic plan of organization that would take care of present and future requirements.

Plan of Proposed Organization

The plan of organization shown upon the chart here presented may leave the impression that it is too elaborate, that it is too involved. But you must remember this one point—and if you ever lose sight of it you will lose sight of the fundamental reason for your present small membership—that of the great number of electrical contractors and dealers in this country, the large majority will never be able to attend any but the single meeting held in the lower group (local meetings). That is as far as they will be able to go. Financial and other conditions will not permit of their even traveling to the district meeting, nor to the state meeting, nor to the division or national meetings, and if you cannot provide a plan which will permit of an organization where all matters discussed above may be passed upon and presented for discussion below, you cannot interest the thousands of concerns in this business. So the idea that I have had in mind at all times was to provide a simple organization within the reach of all and, at the same time, provide a connecting link where the bigger problems discussed above in the larger organization could be passed upon by the smaller organization. Less than 10 per cent. of the membership of this proposed organization will ever get to a national meeting, no matter where it is held.

Lack of Definite Sales Policies

Another ill in our industry is the lack of definite, known sales policies on the part of the manufacturer, the wholesaler, and the retailer. I challenge any man here present to get up and clearly outline the sales policy of any five manufacturers in the United States. That condition, that lack of a definite policy on the part of the manufacturer, results in many misunderstandings with consequent demoralization, wasted energy, and troubles to both parties. I recommend that each company summarize its own problems, define its policy, and make public announcement, so that we will know where each and every one stand and we will then be in a position to make an intelligent decision as to the concerns we care to deal with and the products that we care to handle. Such well-defined policies are in common practice in almost every industry except the electrical industry.

Lack of Retail Distribution

Another great ill in our industry is the lack of retail distribution. The basic causes leading up to a lack of retail distribution are many. Immediately when they are understood and solved, retail distribution will develop at a very rapid rate.

And this one question of lack of retail distribution suggests that I point out what I claim to be a scientific method of electrical merchandising according to the "Wheatstone Bridge" principle. I struggled with this question for more than seven years. I simply mention that in passing, to impress upon you the fact that I have not jumped at conclusions; that I have given due consideration to all of these problems, obtaining opinions from many men in the industry, discussing these questions freely and arriving at my conclusions.

We have in the electrical industry a condition to deal with that is probably more serious than any other single item, in that the success of our whole industry depends upon proper merchandising methods. Electrical merchandising, at this time, and in the past, has been in the control of men trained along technical and engineering lines—a profession which we are proud to recognize. But, on the other hand, I claim that scientific electrical merchandising is just as much a profession as electrical engineering. But to get men of an engineering trend of mind to appreciate that fact is our real difficulty, because the master mind on engineering problems believes that he possesses a master mind on merchandising problems. Existing conditions should convince anyone that this is a fundamental error. What we need in this industry—and particularly in the larger companies, whether they be manufacturing, wholesaling, or central station institutions—are men trained along merchandising lines, and that all questions pertaining to merchandising shall be handled by men of that special training, rather than left to the will of engineers who do not understand the problem. That suggested the thought that if we are going to present this question of merchandising to men of engineering minds we must talk in language that they understand. They certainly have not shown to us that they understand merchandising and can talk to us in language that we understand—because we do not understand it and do not admit that the present policies are correct. And so I have concluded that if I am going to talk to men of engineering minds, I am going to talk to them in language that they will understand. And so I worked on this principle of the "Wheatstone Bridge," believing that every engineer, no matter how competent or otherwise, at least understands the principle of the "Wheatstone Bridge," the basic principle of electrical measurement. If I could apply to electrical merchandising the basic principles of the measurement of electricity then Mr. Engineer would understand that there was something to merchandising.

Wheatstone Bridge

What did we find? We found that the "Wheatstone Bridge" not only supplied the fundamental necessary to the development of our industry, but it supplies every fundamental necessary to the merchandising division of our business, and the organization of our business, as I have pointed out in the little pamphlet that has been distributed.

The whole question of merchandising, simply put, means that we must have a balance. We have to contend with manufacturer, central station, wholesaler, retailer, and the consuming public, and if we cannot keep all five interests in balance, then our time is consumed in lost motion, due to friction and wrangling between the branches. How are we going to get a perfect balance without the "Wheatstone

Here He Is—

The Modern Santa-Claus

Santa Claus fights with the Allies—His "Kit" contains only items approved by the Food Controller, the Power Controller and the Commission of Conservation.

*

Every item stands for all-the-year-round efficiency.

*

His presents relieve the monotony of the daily routine.

*

They release valuable hours each day for recreation and pleasure.

*

They appeal to every age and every station in life.

*

Yet withal they are more beautiful, more sentimental, than ever.

BUY
ONLY
ELECTRICAL
PRESENTS

Bridge"? And how are we going to get it with the "Wheatstone Bridge"?

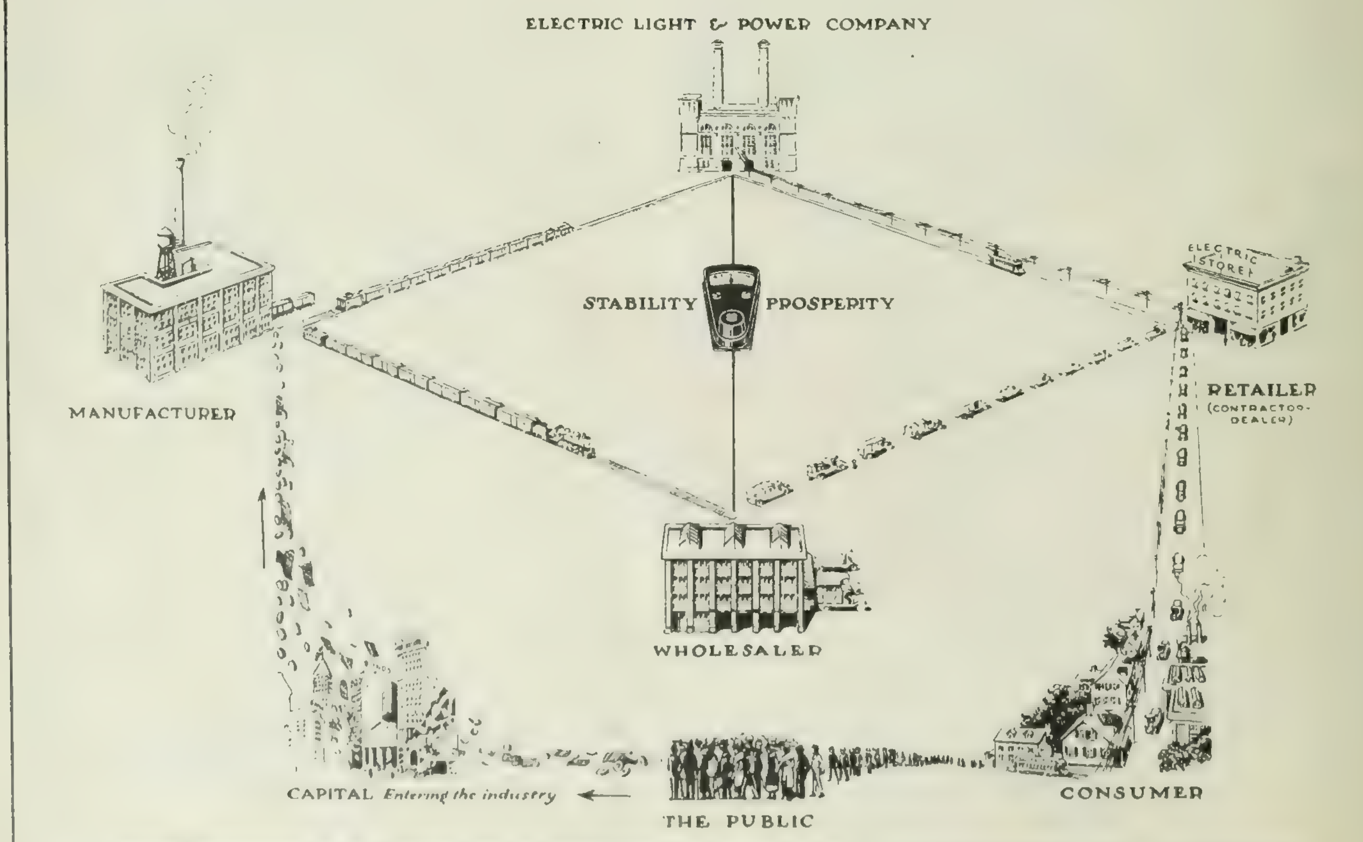
I think you will all agree that at the present time the galvanometer is away off balance. It is off balance because of improper policies on the part of each branch of the industry. Starting with the public, which, again, is the basic cause of our existence, we must first consider its interests. If we do not, we are going to be hampered by improper legislation, restraints and restrictions that will compel us to get back into balance. Much of the legislation in this country affecting the electrical industry is the result of a single branch of the industry getting out of balance with the other branches, creating friction, precipitating antagonism, resulting in the other three branches influencing the public, who, in turn, have passed laws detrimental to another branch.

I saw evidences of that condition in many sections of the country. There should be no need for regulation of public utilities, if the public utilities will regulate their own actions.

Explanation of Wheatstone Bridge

Starting with the public, the first point of contact is with the financial interests, made up of the public, but a class. From the public our money concentrates in these financial centres, in all the various communities, in the form of capital, and it is from that class, either represented through banks, trust companies, or other institutions, or the public direct, that we must draw our capital to the industry. So long as the "Bridge" is in balance and the public are satisfied, and returns are justified, money will flow; and as it flows the first point of contact is with the manufacturer. Without the manufacturers' product we would not have the industry. The manufacturer, therefore, will take off his requirements of capital for manufacturing development. The capital next passes to the central station, because without the energy the other two branches could not progress. So the central station must next take off its share of the capital. Next comes the wholesaler and retailer, the two factors which have to do with distribution. So that all factors must constantly remain in balance—otherwise this line is broken.

After we have provided capital, and manufacturers, central stations, wholesalers, and retailers have been created, then we start on our journey of merchandising. I claim that each interest involved should, rightfully, be recognized as possessing the right to sell its product to whoever it pleases, whether it be wholesaler, central station, retailer, or even to the public direct, and we should never commit any act or discuss any point that tends to prevent any interest from so doing. The moment we do we throw the "Bridge" out of balance, because that is a fundamental privilege extended under the laws of our country, which permit any concern to conduct its business as it pleases, so long as it is by single effort, and the minute you attempt to prevent, by word of mouth, or otherwise, any manufacturer, wholesaler, central station, or anyone else, from transacting their business in the way that they have concluded is best for them, difficulty is encountered and the "Bridge" goes out of balance again. But in preparing the "Bridge" you will note that I have very carefully placed the manufacturer, the central station, the wholesaler and retailer at the extreme points of the bridge, to clearly indicate that in the distribution of the product from manufacturer to consumer it is not necessary for merchandise to pass through any fixed channel. It is not necessary for the product of the manufacturer to be sold through the wholesaler. In that case the line would go down here and out. Nor is it necessary for the manufacturer to sell generating apparatus through the central station. In that case the line would go through the central station. Nor is it necessary for either of these three branches to transact their business


ELECTRIC LIGHT & POWER COMPANY
ELECTRIC STORE
STABILITY
PROSPERITY
MANUFACTURER
RETAILER (CONTRACTOR-DEALER)
WHOLESALER
CAPITAL Entering the industry ←
CONSUMER
THE PUBLIC

Graphic representation of the Goodwin plan of merchandising and reorganization of the electrical industry so as to co-ordinate the interests of the manufacturer, central station, jobber, electrical contractor and dealer in such a way as to result in a business for each, characterized by stability and prosperity. The diagram makes use of the principles of the Wheatstone Bridge and calls for a balancing of the elements involved in much the same manner as required in the operation of that electrical instrument.

through the retailer, because, in that case, the line would have to go right through the retailer. The idea is simply this: That all interests must recognize the interests of others, that in merchandising passing from manufacturer to consumer you must make contact with the various branches. When the manufacturer proceeds to reach the consumer he is faced with the wholesaler in the path of his progress; and he is likewise faced with the retailer in the path of his progress, and if his plan of merchandising is fundamentally correct he has made due provision for all points of contact, and no friction results. If, for instance, you attempted to force the flow of material through these various channels, what would happen? Mr. Manufacturer, in his endeavor to reach the public, may find himself blocked by the wholesaler, who would simply decline to market his product in the way that Mr. Manufacturer demanded, and the manufacturer would have to go out of business, if such a condition were possible. We can never advocate any such insane idea in electrical merchandising. But if the wholesaler is entitled to a place in the process of distribution he will remain there so long as he is an economic factor, and so long as he is an economic factor it is desirable for the manufacturer utilizing that means of distribution to bear in mind that he makes contact with the wholesaler, even though he sells his product direct to the consumer; and if he bears that in mind he has provided a differential in his selling discounts, which, summed up, simply means that business will not be placed in the hands of either wholesaler or retailer without the services that must be rendered; that Mr. Wholesaler and Mr. Retailer can earn a compensation if they render service; but, if they sit idly by, in their offices, and answer the questions I heard some of the retailers answer yesterday on the question of merchandising, Mr. Manufacturer or Mr. Wholesaler, will be compelled to go direct to the consumer in order to get an outlet for his product.

Error of Purchasing on Price Basis

One of the fundamental errors made by electrical contractors—and I know many of them, and many of them are my personal friends—is their almost insane desire to purchase on price. Did anyone ever hear of an electrical contractor purchasing anything without first qualifying, "What is your price?". That is the basis of buying. Fundamentally it is wrong. When you buy you buy with an object in mind, and that object is to sell; and the object in selling is to produce a profit, and that is what you are interested in. It is often said that a good buy is a good sell. Let us reverse it—a good sell is a good buy. Profit never results until the sale is completed. Be more considerate, when you purchase, of the possibility of selling at a profit, and be less concerned with the price at which you buy. When Mr. Salesman, so-called, waits upon you and offers to sell you a product, give him this question and see whether he is going to sell or not: "How am I going to sell your commodity, and what profit am I assured—reasonably assured—when I sell it?" A man or a concern who sells you on price, and price only, has no consideration for your interests. What we want in the electrical industry is constructive selling, with the fundamental idea that the transaction from manufacture ror wholesaler to contractor does not complete the sale. The sale is not completed until the product is in the hands of the public, you have received your money, taken care of your overhead, and have something left for a profit.

Tendency of All Branches to Indulge in Functions of Others

Another fundamental error is the tendency of manufacturers and wholesalers, and others, to indulge in functions that could more economically be taken care of by others. I believe that if a careful study were made, there are very few wholesalers in the country to-day who are conducting a retail department at a profit. They apply the principles of wholesaling to the business of retailing. The expenses of retailing are charged to wholesaling, and vice versa. As a result of that condition wholesalers are to-day demanding from manufacturers margins far in excess of those they require to economically distribute the product of the manufacturer. I mean by that that it is unfair to present to a manufacturer figures which show that your overhead is 17 per cent. and that you must have a compensation above that figure before you will be interested in marketing his product; when, as a matter of fact, your proper rate of per cent. should be 12, but it has been elevated to 17 per cent. because you have a retail department. If a wholesaler is going to retail, then let him segregate his business, just as he would segregate wholesaling and contracting; charge to retailing the proper items; and I want to tell you that no wholesaler in these United States to-day can indulge in retail electrical merchandising at any 17 per cent. overhead. But because he has consolidated wholesaling and retailing, he only obliges the manufacturer to concede him a discount equivalent to his overhead for wholesaling, plus a fair rate of profit; and, in reality, he retards the retailer who has an overhead of probably more than 25 per cent.; and so Mr. Wholesaler and Mr. Manufacturer, without realizing what they have been doing, have been obliging the retailers of this country to conduct a retail business on a wholesale margin.

Curse of Cheap Price Idea

Another ill of the industry, and one that is not appreciated by electrical people, is that there exists a belief on the part of the contractor, wholesaler, manufacturer, and central station interests that it is impossible to sell our commodity unless we offer it at a cheap price. And so the price of the electrical commodity has been lowered to such an extent that we haven't even left provision for actual overhead expense, and the various interests participating are unable to maintain their own institutions. I mean by that that it was the belief, which still obtains in many directions, that we would never interest the electrical public in household devices unless we could get the price of an electrical flat-iron down to about a dollar and a half. After several hundred years of merchaning, manufacturers of an ordinary cast-iron flat-iron with a detachable handle are able to sell their product at about a dollar and a half, and we attempted to compete with that particular article. The result was no profit for wholesalers or retailers; a lack of desire on the part of the wholesaler or retailer to put any sales effort behind the commodity, resulting in the necessity of the central station branch of the industry marketing this product, because of the desire to fill their lines with kilowatts. Only recently we have found that, due to increase in cost of raw material, labor, and other causes, it has been necessary to increase the prices of all commodities. It has not retarded the sale of anything. We must never get the price so low that we will be obliged to reduce or remove the margins to those participating in the sale. The public will purchase our commodity when it is properly presented to them, and the question of price, whether it be three and a half or three dollars and sixty cents for an electrical flat-iron, after all, is immaterial. We must appreciate the fundamental principle of selling and let the question of price take care of itself. This tendency extends to the contractors in an acute form, and in order to bring out the point I just want to recall what happens to you when you drop into the average haberdashery. You go in and say to the clerk, "I would like to buy a dollar shirt," and out comes the dollar shirt. Immediately a two-dollar, a three-dollar, and a five-dollar shirt are also laid out, and the poor little one-dollar shirt is lost in the pile, and your eye immediately turns to the five-dollar shirt; and how often do you buy the one-dollar shirt The true merchant never attempts to put any effort behind his low-priced commodity. His effort is always to cause you to buy something better than you intended to buy; and, having convinced you and completed the sale of what you went in to purchase, does he stops them: "May I show you some socks, underwear, collars, or ties?" And before you have a chance to say no, the counter is littered with them, and you buy a tie and a pair of socks and a few other articles that you didn't really want at all. That is salesmanship and merchandising.

What does the electrical contractor do? I will tell you what he does: He gets the plans and specifications from the architect, and not in one case out of a thousand does he ever suggest an addition. But he immediately points out to Mr. Architect how much he can cut out of the job and save money. Your idea of merchandising is to give a man less than he actually wants and needs, and so our country is just littered with buildings of all kinds and character, in which it is almost impossible to connect an incandescent lamp, let alone a portable, or an accessory of any kind, and in almost every case their elimination has been through the suggestion of the electrical contractor. The contractor should never bid on a job of any kind without offering some kind of a suggestion that it ought to be a little better, or that something ought to be added. That is merchandising.

Lack Knowledge of Costs

Lack of knowledge of costs has been talked of so often and has been written of in the papers so much, but even so, as important as it is, it is not understood. I suggested to some electrical contractors in New York City, at one of their meetings, that it was very important that they should gather information from their members as to their cost of overhead. I was answered by a gentleman present, who said that he believed that that was incidental to their problem; that it wasn't quite necessary. I know that a great many of the men present in that meeting believed that they had an overhead of about 10 per cent., and when the figures came in, if my memory serves me correctly, the lowest man was about 15 per cent. and the highest man was about 24 per cent. Do not guess at your overhead. If you don't know, go out and hire an expert accountant; go to any jobber in the community and ask for the services of his head bookkeeper or credit man, and he will gladly come into your office and take off a statement and tell you what your overhead is. And then, after you know, remember that every operation must provide for the cost of material, labor, overhead, and profit. You must remove that mistaken idea that exists in the minds of many contractors, that with increasing volume you have decreasing costs. I can prove to anyone who needs the proof that increased volume results in increased cost, because the greater the business the more attention to details, and the more attention to details the greater security of the business, and the greater the security of the business the more money it costs to operate.

A New Small Squirrel-Cage Induction Motor

A new line of induction motors has been recently placed on the market by the Crocker-Wheeler Company, Ampere, N.J. These motors, known as the C-W Form P motors, are of the squirrel-cage type, ranging in size from one-half to three horse-power, and are designed for constant-speed operation on 60-cycle polyphase circuits. The mechanical construction of these motors is compact, rugged, and simple. Rigid frames and end shields, liberally-designed shafts and bearings, ample air gaps, and good insulation enable these motors to withstand the severe service met with by this type of motor. Good starting torque and high power-factor are among the electrical features of these motors, the long and successful experience of the Crocker-Wheeler Company in designing and building motors for application to all classes of service resulting in this design of motor, in which the electrical characteristics are combined in such a way as best to meét the requirements of small-motor applications.

Among the special features of these motors is their efficient ventilation. A number of the rotor bars project for a short distance at each end of the rotor core. These projecting ends of the rotor bars serve as efficient fans. Attached to the inside of each of the bearing shields is a pressed steel guide that separates the incoming from the outgoing air. Air is thus drawn into the motor at each end through openings near the shaft and then forced by the fans against the stator winding, around the ends, and finally out through the holes near the outer periphery of the shields. This construction prevents the outgoing warm air from mixing with the air being drawn into the motor. A maximum cooling effect, with a minimum of windage loss, is thus obtained. Strong insulation of the stator windings is obtained by placing the coils in well-insulated slots and impregnating the complete core and winding with a special varnish which renders them moisture-proof and enables them to withstand acid fumes. After the core and coils are removed from the impregnating tanks they are baked and again dipped in varnish and baked. The bearings are large, with oil grooves so located that no matter in what direction the belt-pull may be there will be a film of oil between the shaft and the bearing, thus reducing friction to a minimum. Dust and dirt are kept out of the bearings by sheet-metal caps at the ends and by self-closing oil-well covers. Slotted feet, cast integral with the stator frame, facilitates accurate belt-tension adjustment.

Look Who's Coming!

The Canadian Westinghouse Company have issued an attractive Christmas folder, entitled "Look Who's Coming!" to which the answer, on opening the folder, is a jolly-looking Santa Claus, with a quantity of Westinghouse ware in his ample sack. The folder proceeds to describe window displays, display cards, newspaper cuts, etc., which are supplied by this company to the retail trade and which illustrate in a very attractive way the various electrical household appliances manufactured by the Westinghouse Company.

Don't Take It For Granted

Don't take it for granted this Christmas that the public knows all about electrical goods. The average man or woman has never been brought to realize one-tenth of what, on account of your intimacy with the business, has become second nature to you. The next three weeks is the crucial time in which to get the attention of the public. For example, try what a list like that given herewith will show them. It may be old to you but it is new to them and will make them open their eyes to the almost unlimited applications of electricity. Don't overlook the fact that many householders still think of electricity as good merely for lighting and ironing. There is no reason in the world why they do not use other household appliances except that—**they don't appreciate the value of them.** Let it be your aim this Christmas season to tell, over and over again, the story of the convenience, luxury and low cost of electric operation of dozens of little home appliances—a story that is old to you and me but still new and wonderful to the public and still quite incredible because it seems too good to believe.

Portable Electric Lighting Plants

It is stated that in both the French and Italian armies portable electric lighting plants are being largely made use of for the illumination of officers' quarters. The sets consist of a water-cooled petrol engine, direct-coupled to a generator, both being mounted on a wooden platform capable of being carried by a couple of soldiers. Wiring and lamp sockets are packed separately, and are in charge of an electrician. The entire outfit is brought up on a motor wagon, and, with the aid of three or four men, staff quarters can be fitted up with an electric lighting installation in about an hour's time.—Electrical Review.

Electrical Presents Mean True Friendship

Gifts that are really appreciated—No one thanks you to-day for a Christmas Present that is not of permanent use—Every item on this list means "value received."

TOYS AND NOVELTIES

- Aerial swing
- Aeroplane
- Animals, electric eyed
- Automobile
- Circuit breaker
- Crane and hoist
- Dynamo
- Electric boat
- Electric engine
- Electric questioner
- Electric range
- Elevator
- Electrically operated dog house
- Experimental laboratory
- Fan
- Ferris wheel
- "Fun" motor
- Gas engine
- Hydro-electric generator
- Lamp post
- Locomotive
- Merry-go-round
- Motor
- Motor and countershaft
- Power station
- Railway outfit
- Steam engine and dynamo
- Telephone
- Thriller magneto
- Train
- Transformer
- Trolley car
- Water power plant
- Book on electricity
- Electric toy
- Picture and post card projector
- Magic lantern
- Motion picture machine
- Shock coil
- Battery
- Battery lantern
- Flashlight
- Dark room lantern
- Lantern attachment (battery
- Illuminated pads and pencils
- Pistol flashlight
- Bicycle lighting outfit
- Canoe lamp
- Electric candle
- Christmas tree lighting outfit
- Christmas tree lamp clusters
- Bird, fruit and nut lamps
- Miniature incandescent lamp
- Electric scarfpin
- Battery fan
- Battery motor
- Chalk eraser cleaner
- Corn popper
- Horseshoe magnet
- Magnet charger
- Telegraph instrument
- Wireless telegraph instruments
- Tool kit
- Baby flatiron
- Nursery light

LUXURIES AND CONVENIENCES

- Alarm clock
- Battery lantern
- Bed lamp
- Candlestick
- Chair lamp
- Chimes and bells
- Cigar lighter
- Comb and curling iron
- Curling iron
- Curling iron heater
- Desk companion
- Desk fan
- Desk lamp
- Electric fountain
- Electric watch charm
- Electrically lighted wall mirror
- Electrically lighted table clock
- Flashlight cane
- Flashlight umbrella
- Floral decorations
- Flower basket
- Foot warmer
- Hair drier
- Hair waver
- Hand lantern
- Heating pad
- Illuminated pads and pencils
- Illuminated table ornament
- Library lamp
- Luminous switch plate
- Massage vibrator
- Novelty electric candle
- Oil lamp attachment
- Ornamental bird cage
- Ornamental fan stand
- Ornamental pendant cluster
- Perfumer
- Piano lamp
- Portable radiant heater
- Reading lamp
- Reed or wicker portable
- Reminder clock
- Shaving mirror
- Shaving mug
- Silk hat iron
- Silk lamp shade
- Talking machine motor
- Talking machine record light
- Traveler's iron
- Traveler's companion
- Traveler's stove
- Traveler's lamp, cord, and plug
- Vest pocket flashlight
- Watch case flashlight
- Writing desk lamp

HOUSEHOLD UTILITIES

- Bell ringer
- Bath heater
- Boiler
- Broiler
- Cereal cooker
- Casserole
- Chafing dish
- Chocolate and cream warmer
- Churn
- Clothes drier
- Clothes washer
- Coffee mill
- Coffee percolator
- Coffee set
- Combination cooker
- Cook stove
- Corn popper
- Cream whipper
- Dish washer
- Disc stove
- Disinfector
- Drink mixer
- Egg boiler, cooker or steamer
- Egg set
- Egg tester
- Electrically heated faucet
- Fan
- Fireless cooker
- Flat iron
- Food carrier
- Food warmer
- Fruit juice extractor
- Fruit and vegetable peeler
- Frying pan
- Fumigator
- Gas lighter
- Griddle
- Grill
- Hand lamp
- Hot closet
- Hot plate
- Ice cream freezer
- Illuminated porch number
- Immersion electric heater
- Ironing machine
- Kitchen power unit
- Lemon squeezer
- Meat chopper
- Meat slicer
- Milk warmer
- Plate warmer
- Radiator
- Rain alarm
- Range or stove
- Refrigerator
- Regulating lamp or socket
- Saute pan
- Serving table
- Sewing machine motor
- Sewing machine portable lamp
- Stew pan
- Sterilizer
- Table cooking set
- Table lamp
- Tea ball pot, kettle or urn
- Tea wagon, electrically fitted
- Toaster
- Toaster-stove
- Utility motor
- Vacuum cleaner
- Waffle iron
- Water purifier

AUTOMOBILE DEVICES

- Battery lamp
- Clock
- Foot warmer
- Lamp kit
- Lock
- Signal bell
- Signal lights
- Trouble lamp
- Cigar and pipe lighter
- Electric horn
- Electrically heated gloves
- Engine and radiator heater
- Garage and tire pumps
- Garage portable lamp
- Headlight dimmer
- Headlight glare diffuser
- Headlight voltage regulator
- Hydrometer for battery testing
- Inspection lamp and magnet
- Limousine annunciator
- Limousine cluster light
- Limousine telephone
- Limousine radiator
- Pocket testing meter
- Signal gloves
- Spark plug
- Spark plug intensifier
- Spark plug tester
- Steering wheel warmer
- Spotlight
- Storage battery
- Storage battery tester
- Vulcanizer

SICKROOM ACCESSORIES

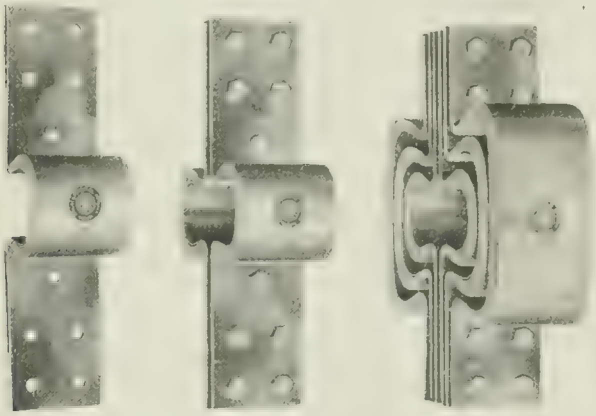
- Bath cabinet
- Bed lamp
- Body, joint and limb bakers
- Candle or night light
- Deodorizer
- Ceiling clock
- Electrically heated blanket
- Electrically heated cap
- Electrically heated garment
- Electrically heated pillow
- Foot warmer
- Heating device
- Heating pad
- Mechanical exerciser
- Medical battery
- Medical coil
- Medicator
- Milk bottle or food warmer
- Motor chair
- Nurse signal
- Obesity apparatus
- Sterilizer
- Therapeutic lamp
- Treatment apparatus
- Vibrator
- Violet Ray apparatus

ELECTRICAL RECORD

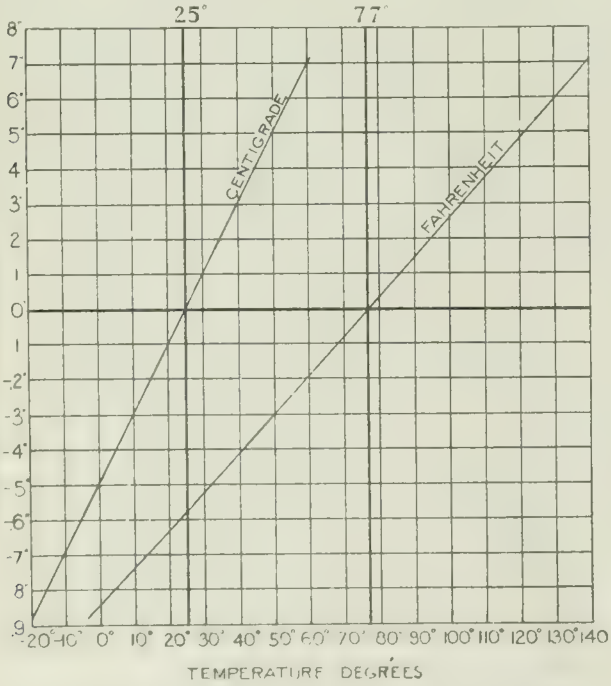
What is New in Electrical Equipment

Linear Expansion of Copper Bus

In many central station and industrial plants the linear expansion of bus runs with change of temperature, and has given rise to much difficulty. In some cases this displacement of bus bar due to expansion has damaged the insulators used in the erection, and has in other cases destroyed the alignment of switches placed in immediate connection with the bus. The chart (below) is arranged very conveniently for the direct determination of the actual expansion of a bus run of 100 feet in length over any reasonable range of temperature established in either degrees, Centrigrade or Fahrenheit. For simplicity the expansion is taken both ways from an assumed installation temperature of 25 degrees C. (77 degrees F.), so that over all ordinary ranges the total expansion for 100 feet of bus run will be the sum of the values shown above and below the installation length. For example, a hundred length of bus, on which the temperature might vary from 10 degrees C. to 55 degrees C. would contract 0.3 inch below installation length at 10 degrees C. and expand 0.6 inch over installation length at 55 degrees C., or, disregarding the installation entirely, would have a total change of length of nine-tenths of an inch over the temperature range chosen. The co-operation of the Bureau of Standards in establishing the varying coefficient of expansion for copper has made the presentation of this data in this most convenient chart possible by the engineering department of one of the electrical manufacturers.



Bus-bar expansicn joint.



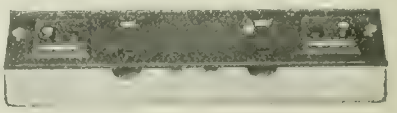
Linear expansion of copper for different temperatures C. and F.

Any damage to the insulators or nearby switches may be forestalled by the judicious relief of this bus travel by means of expansion joints. It should be noted that the expansion determined from the chart is the actual expansion and is somewhat greater than the relative expansion of the bar to the supporting structure. The supporting structure has generally less expansion over any range of temperature, and is not subjected to such a wide variation of temperature as the bus bar itself, nor does it respond so quickly, since the temperature variation is first in the room air and not in the building material itself.

To forestall the difficulties arising from bus bar expansion one of the manufacturers has produced an expansion joint identical in principle to that previously made up and used by several companies. These joints bolt into the bus and impose no poor connection nor reduction of bar stack conductivity. These elements are furnished for stacks of any number of bars of all the bar sizes and spacings common to present practice. The conductivity of the joint is equal to or greater than that of the bar stack which it joins, and is very flexible because of its thorough lamination. These joints are produced in all sizes by the General Devices and Fittings Company, of Chicago, Ill.

Dead Front Panel Switches With Connections for Cartridge Fuses

The Bryant Electric Company, of Bridgeport, Conn., announce an addition to their comprehensive line of dead front panel switches. Devices of this character, both in the rotary and push-button types, have been in use for some time. These, however, have been fitted with connections for plug fuses. Now, where the conditions do not permit of the use of plug fuses, as, for instance, on circuits above 125 volts, a Bryant panel unit can be had, with connections for cartridge fuses. The great convenience and economy of these switches is readily apparent when it is borne in mind that, with a small quantity of units in stock, a dealer or contractor is enabled to provide for the immediate assembly of a panel board of practically any number of circuits without requiring special mounting or the collation of a number of different parts.



Each unit is complete in itself, consisting of a substantial porcelain base, upon which are mounted two demountable switch mechanisms with fuse connections, all ready for connecting to the circuits. Aside from the feature of convenience the method of affording safety against shock to the operator is worth noting. The entire front of each unit is fully protected by substantial sheet fibre. This effectively covers and protects all live parts, so that it is impossible for a careless or thoughtless operator to get a shock. The covers or front of these units are regularly furnished in black enamel, but may be had in other finishes when specified.

Automobile Toggle Switches

The cuts herewith represent single pole automatic toggle switch, with flush plate, single pole switch with recessed plate, lock switch, and three-gang switch combination, now manufactured by the Harvey Hubbell, Inc. The automatic toggle switch was designed with a view toward effecting an improvement over the existing forms of switches for automobile use, such as those employing the miniature push-button or the single plunger type which consists of pulling out and pushing in a small handle. It is claimed that the toggle or lever or tumbler form of switch, as it is variously referred to, and as exemplified in the single pole switch, is the most convenient form for operating in an automobile. To throw on the current the toggle handle is simply pushed up and the reverse operation opens the circuit. It is also argued by the manufacturers that in appearance the toggle switch is artistically superior to other forms now on the market. Another very important feature is the indicating arrangement of the toggle. To the user of this switch it becomes second nature to press the handle up to turn on the lights and down to turn them off.

Single pole.

3-Gang switch.

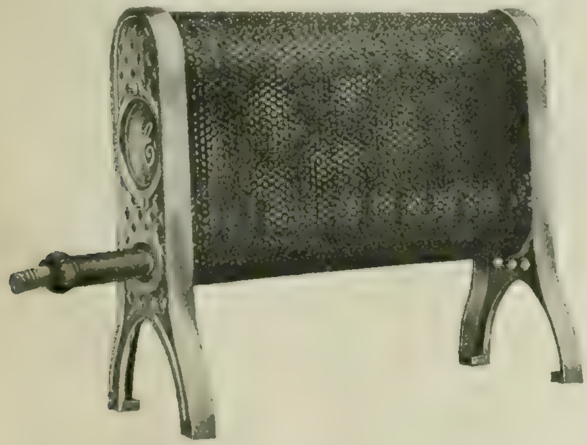
Recessed plate.

Lock switch.

These switches have a sufficient carrying capacity to carry the load of almost any battery or magneto circuit, and have successfully withstood the test as high as 50 watts. The interior mechanism is simply and strongly made. The switches can be furnished in single pole and three-way types with flush plate; single pole and three-way, with recessed plate; momentary contact type; double form or momentary contact; battery magneto circuits; single pole and three-way lock switches. Lighting systems of more or less special character can be arranged by gang combinations made up of these various types.

New Electric Heater

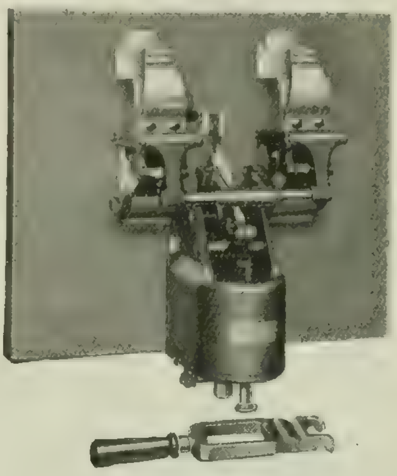
A new electric air heater has just been placed on the market by the Canadian General Electric Company. This will be found of great service for the bathroom, sick room or nursery, being built so substantially that it will last for years. It can be attached to any lamp socket. This heater is light in weight and may be moved wherever required. It is supplied with 8 feet of cord and attachment plug



Solenoid Operated Field Switches for Remote Control

The Canadian General Electric Company have developed a line of double pole solenoid operated field switches. The switches are usually mounted on a base near or attached to the field rheostat, or they may be located on the exciter board remote from the main control board. In all cases they are operated by means of small control switches of the push and pull button type which are located on the bench or vertical boards.

Solenoid operated field switches are similar in construction to non-automatic, solenoid operated air circuit breakers, the principal points of difference being the omission of carbon secondary contacts and the addition of a field discharge switch. The field discharge switch is so arranged that the opening of the solenoid operated field switch introduces a resistance across the field of sufficient value to prevent any injury to the field coil windings by the inductive kick.



Single pole field switches are provided with operating coils, one for closing and one for tripping, both mounted in a magnet frame immediately below the contact parts. For double pole field switches, one set of operating coils is provided, the magnet frame being centrally spaced between the two poles.

Removable handles are provided so that any of these switches may be closed by hand. Insulated buttons, attached to the tripping coil plunger and easy of access, provide for hand tripping.

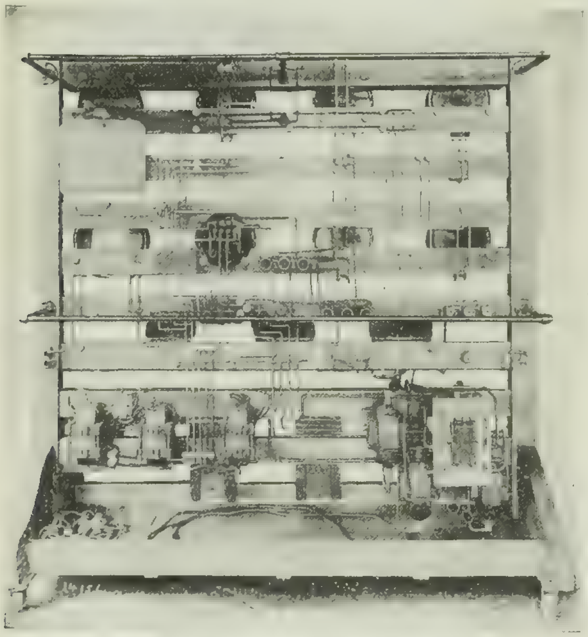
Solenoid operated field switches for synchronous motors started from the alternating current source are ordinarily made of two single pole elements with independent closing and opening coils. In these cases, both poles of the field switch are closed simultaneously but one pole precedes the other in opening, connecting the discharge resistance across the field. This time delay in the opening of the second pole of the field switch is obtained by means of a time limit relay connected in the control circuit. The discharge resistance circuit is opened when this second pole finally opens.

A Unique Experimental Portable Switchboard

Mr. F. W. Springer, professor of electrical engineering at the University of Minnesota, has recently completed a rather unique experimental switchboard for use in the university's laboratory, which has proven of great help to students in solving central station problems, in addition to providing means for making interesting tests. The switchboard is made of a skeleton wood frame mounted on three-inch rubber tired roller bearing casters. The equipment on the board includes a complete set of damped Westinghouse central station switchboard instruments and accessories, as follows:

Two 80-ampere and two 40-ampere current transform ers, with a suitable pair of double throw, double pole switches, so that either set of transformers may be used. Three 100-200-300/100 volt, 200 watt potential transformers. One three-phase, 2200-volt, static ground detector, not connected. One 100-volt a.c. voltmeter with plugs and receptacles. One 100-volt, 45-75 cycle frequency meter. One 5-ampere, 60 cycle, ammeter, with plugs and receptacles. One three-phase, 110-volt, 5-ampere, 60-cycle power factor meter. One 110-volt, 60-cycle, synchroscope, together with a set of synchronizing lamps and accessories. One polyphase, 110-volt, 5-ampere, 60-cycle, wattless-factor meter. One polyphase, 110-volt, 5-ampere indicating watt meter. One 300-volt direct-current voltmeter for excitation circuit. One 10-ampere direct-current type ammeter for excitation circuit. Two circuit breakers having a range up to 50 amperes and 750 volts, placed at the bottom of the board, together with special cables for connecting them in the main circuit as desired.

Switches are provided for the following purposes: Two for short circuiting the secondaries of the current transformers. Three for changing potential primaries. One for changing potential primaries from three-wire three-phase to four-wire two-phase. One for short circuiting the shunt terminals to the direct current ammeter. A push button for direct current voltmeter, so that it remains ordinarily open circuited. One main switch consisting of four single-throw blades, and one main switch with the four blades combined.


Portable Experiment Switchboard.

The board being portable, can be shifted readily to any desired position in the laboratory and thereby made to fit into many experiments in connection with single, two and three-phase tests of motors, generators, transformers, controllers, lines, etc. The common use of the board, as developed by seven years of use, may be outlined in detail as follows:

As a perpetual exhibit of central station instruments as a group and as individuals, available to visitors and students.

As an illustration of the principles of the methods of connecting polyphase central station instruments, made particularly clear by the use of white insulated wire for the potential circuits, and also by suitably grouping these circuits, and by using different sizes of wire for the other circuits. Blueprints are also used in connection with the board as an exhibit showing the wiring both from the rear and the front.

Frequently the cases of the instruments are removed for purposes of study.

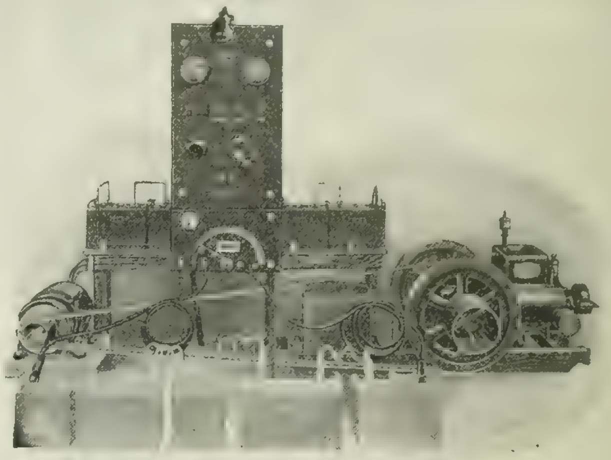
For calibration and inter-comparison of the wattmeter, ammeter, voltmeter, power factor meter, etc.

Used frequently in connection with behavior or operating tests in order to illustrate general principles, especially those arising in starting machines of various types.

Sometimes used in performance tests of motors, generators, transformers, etc., where the greatest possible accuracy is not demanded.

Combined Lighting and Battery Charging Set

The Main Electric Manufacturing Company, of Pittsburgh, have recently placed upon the market a combined lighting and battery charging set, as illustrated. This set is made in two sizes—namely, 40 volt, 800 watt, d.c., and 40 volt, 1,500 watt, d.c. The former will light forty 20-watt lamps when no batteries are being charged; it will light twenty 20-watt lamps and furnish 10 amperes for battery charging, or will light ten 20-watt lamps and furnish 15 amperes for battery charging. The capacity of the larger set may be divided up and utilized in the same way. The chief advantage of this equipment seems to lie in the fact that it is economical for both lighting and battery charging. A common method of charging batteries is off a 110-volt circuit through resistance, the efficiency depending on the number of cells being charged in series. Thus if only twenty 2-volt cells were being charged, utilizing 40 volts, there would be a loss of 70 volts, or practically 75 per cent., in the resistance. The low voltage charging set is thus more efficient.



Two Christmas suggestions—Toy battery Motor and Boudoir Lamp in Ivory, and Brass—Nerlich & Co., Toronto.

New Books

Practical Electricity—by Terrell Croft; McGraw-Hill Book Company, Inc., New York, publishers; cloth binding; size 8 x 5½; 320 pages; 306 illustrations; $2.50 net. The primary object of the book is stated to be to present the fundamental facts and theories relating to electricity and its present-day applications in a straightforward, easily-understood way for study by any man of little mathematical training who desires to acquire a working knowledge of the subject. Secondarily, it is designed for university graduates who desire a medium for reviewing, refreshing, and re-constructing in line with modern theory and practice, their previous conceptions of electrical and magnetic phenomena. An important feature of the book is the amount of space given over to the modern electron theory. The scope of the work may be gathered from the following section headings: Matter and the Electron Theory; Magnetism; Fundamental Ideas Concerning Electricity; Currents of Electricity; Electromotive Force, Current, Resistance, and Ohm's Law; Work, Power, Energy, Torque, and Efficiency; The Generation of Electrical Energy; Electric Circuits; Electromagnetism; the Magnetic Circuit; Magnetic Leakage; Calculation of Magnet Windings; Applications of Electromagnets; Magnetic Traction and Lifting Magnets; Hysteresis; Contact Electromotive Forces; The Principles of Primary Cells; Types and Connections of Primary Cells; Electrolysis; Storage Batteries; Electromagnetic Induction; Mutual Induction; Self Induction; Inductance; Self Inductance; Mutual Inductance; Energy Stored in the Magnetic Field; Eddy Currents; Principles; The Shunt Motor and Its Starting and Control; Series and Compound Wound Motors; Direct Current Motor Power, Current and Voltage Relations; Characteristics of Alternating Currents; Alternating Current Generator Principles and Construction; How Alternators Develop Electromotive Forces; Alternating Current Vectors and Vector Diagrams; The Addition and Subtraction of Alternating Current Values; Effects of Resistance and Inductance in Alternating Current Circuits; What Reactance and Impedance Really Mean; Permittance or "Capacity" in Alternating Current Circuits; Figuring Alternating Current Circuits; Power and Power Factor in Alternating Current Circuits; Polyphase Circuits and Systems; Transformers, Their Principles and Applications; Three Wire Distribution and Systems.

Hydro-electric Power Stations—by Eric A. Lof and David B. Rushmore; John Wiley & Sons, Inc., New York, publishers. Cloth bound; 6 in. x 9 in.; 822 pages; well illustrated; price, $6.00. This book deals with and explains the problems which must be solved in connection with the construction and management of hydro-electric power stations so that the manager or engineer may select power equipment and fully understand the economic factors which enter into each individual situation. The authors have endeavored to describe the most recent engineering practice and have included a considerable amount of information not obtainable in books previously published. It will prove a useful educational treatise for the student and operating man and should result in improved service and operation efficiency of many hydro-electric systems. The scope of the work may be gathered from the following chapter headings:—General introduction; Hydrology; Classification of developments; Dams and headworks; Water conductors and accessories; Storage reservoirs; Power-house design; Hydraulic equipment; Electrical equipment; Economical aspects; Organization and operation.

The annual convention of the Canadian Independent Telephone Association was held in the City Hall, Toronto, Ont., November 21 and 22, at which the following officers were elected: Honorary president, Col. T. R. Mayberry, Ingersoll; president, F. S. Scott, Brussels; vice-president, Myron A. Gee, Selkirk; secretary, A. Hoover, Green River; treasurer, F. D. McKay, Toronto; executive: G. W. Jones, Clarke; P. R. Craven, New Liskeard; Anson Groh, Preston; E. W. Love, Mount Albert; C. W. Johns, Algonquin; F. G. Webster, Creemore; A. McLean, Paisley; George Tait, Bridgeburg; W. R. Wadsworth, Byron; Dr. W. Doan, Harrietsville; H. S. Kenlock, Martintown, and Samuel Cuddaby, Burnt River; auditors, Messrs. E. G. Hoover and E. E. Wilson.

Moonstone.

Dominion-Lite

Moonstone Bowl (above) and Dominion - Lite (right) — Two of the most recent designs of the Jefferson Glass Co., Toronto.

Current News and Notes

Alliston, Ont.

The construction of the Hydro transmission line from Barrie to Alliston is well under way, and it is expected this line will be completed before the new year. It will be extended to the municipalities of Beeton, Tottenham, and Bradford, and will serve the southern portion of Simcoe County, the source of power being the Big Chute plant on the Severn River.

Brandon, Man.

The city of Brandon, Man., has just completed the installation of an automatic telephone exchange supplied by the Automatic Electric Company, Chicago. This city now has 1,794 city and 479 farm telephones in service, representing 11.3 telephones for every 100 people. Up to the beginning of the present year manual equipment had been in service in Brandon, but as they found it necessary to build a new exchange it was at the same time decided to install automatic apparatus, similar to that already in use in a number of cities in Western Canada.

The Manitoba Government Telephones System has issued a little booklet describing the Brandon exchange and giving information as to its operation.

Edmonton, Alta.

Major Gordon Powis, formerly the representative of the Canadian Westinghouse Company at Edmonton, has been killed at the front. He fell at Passchendaele. Major Powis was a B.Sc. of McGill University, and, after graduating, joined the Westinghouse Company at Hamilton.

Fort William, Ont.

The Kaministiqua Power Company, Fort William, Ont., have purchased Victory Bonds to the extent of $100,000.

Montreal, Que.

Mr. G. R. MacLeod, the tramways expert of the city of Montreal, has been granted indefinite leave of absence in order to accept a position with the Imperial Munitions Board in a branch now being organized in Washington, D.C. Mr. MacLeod has made several reports on the Montreal tramways situation.

The earnings of the Civic Investment and Industrial Company, operating the Montreal Light, Heat & Power Company, and the Cedars Rapids Manufacturing & Power Company, continue excellent. For the first six months of the fiscal year the gross was $4,822,710, and the surplus $2,113,685.

A conference of the superintendents of the Southern Canada Power Company was recently held in Montreal They also attended the Montreal electrical luncheon.

The City of Montreal will ask the Quebec Legislature for power to allow the city or a board of engineers to control and regulate the erection of poles on the streets by different companies, and for this purpose to amend the acts incorporating the Montreal, Light, Heat, and Power, Montreal Tramways Company, and their subsidiaries. Further, to annul the agreement entered into between the former town of Sault-au-Recollet and the Back River Power Company as regards the guarantee of the bonds of the company.

The Montreal Light, Heat, and Power Company have purchased the old Ogilvy Building, St. Catherine Street West, for $200,000. The building will be altered for the purpose of converting the lower portion into an extensive showroom for electrical and gas appliances, but this will not be ready until March.

Omemee, Ont.

A by-law will be submitted to the ratepayers of Omemee, Ont., authorizing a debenture issue to provide for a hydro-electric power plant.

Orillia, Ont.

Orillia's new electric power plant at Swift Rapids, on the Severn River, was formally opened on November 22. The new plant succeeds the one at Ragged Rapids, which has been in service for many years. It is a mile and a half farther down river, the change being necessitated by the construction of the Trent Valley Canal. The new dam will provide a head of 45 feet, and it is anticipated the three units, one of which was immediately placed in operation, will develop a total of 5,400 h.p. The old dam and power-house were blown out with dynamite several days previously, four tons of the explosive being used in the operation.

Ottawa, Ont.

The Canadian Tungsten Lamp Company, Limited, Hamilton, Ont., has been awarded the contract by the Dominion Government Department of Public Works for tungsten lamps required for departmental buildings, Ottawa.

Port Moody, B.C.

A six-ton electric smelter furnace is being installed in the Aetna steel works, Port Moody, B.C., and is expected to be in operation by January 1.

Sault Ste. Marie, Ont.

The conciliation board appointed to deal with the dispute between the International Transit Company, Sault Ste. Marie, and their employees have decided on the following wage schedule: Minimum, 30 cents per hour for the first six months; 31 cents per hour for the second six months; 32 cents for the second year; 35 cents for the third year, and 35 cents per hour thereafter.

Sumas, B.C.

The B. C. Telephone Company put forward their right to extend their lines through this municipality in competition with the local farmers' system. The claims of the rival concerns were heard at a recent meeting of the council. Mr. W. H. Fadden, president of the local system, stated that his company was a local co-operative organization, not operating for sole purpose of profit, but to give service to the farmers. He pointed out that it had been granted permission to erect its poles along the roads twelve years ago, and that there was no room for two companies. The B. C. Telephone claims right under its present charter to put up poles wherever it wishes. The council decided to take no steps in the matter for the present.

Truro, N.S.

It is stated that private enterprise is considering the development of a water-power on the Salmon River to supply the town of Truro, N.S., with electric power, and that a proposition will shortly be submitted to the Town Council.

Wiarton, Ont.

The Town Council of Wiarton, Ont., have given notice to the Sauble Falls Light and Power Company, who supply light and power to the town, that the city's agreement with them will expire on December 31. There is, however, no indication that the ratepayers want Hydro power, nor any possibility of having it brought to the town by that date. It remains for the town to either enter into another agreement with the Sauble Falls Company or else take over their plant

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Generation, Transmission and Application of Electricity

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Canada Needs More Power— Shall Our Power be Kept in Canada?

It would be difficult to over-estimate, at this time of national stress particularly, the importance of the annual meeting of the Canadian Commission of Conservation, held a few days ago in Ottawa. It is true that "production" is the all-important word in our vocabulary to-day, but at least we must recognize that conservation is the "hand-maiden" of production, and that all our efforts at producing, in larger quantities, such supplies as are most required in this war depend, both temporarily and ultimately, upon the conservation of our natural resources. For example, we cannot produce wheat if we do not conserve our land; or lumber, if we do not conserve our forests; or power, if we do not preserve for the use of the Canadian people those vast natural resources in water falls with which Providence in His all-seeing wisdom has so abundantly provided us.

Inseparably tied up with production is that other factor on which it is absolutely dependent—power. What can we produce without power? Time was when the farming community seemed to be a self-contained unit, but now with his motors for various purposes, his many domestic heating appliances and his "mazdas" the farmer of Central Canada is almost as dependent as the large cities on the energy of the Pennsylvania and adjacent coal fields of the United States and the waters of our mighty rivers. And what of these two sources of supply—how permanent, how inexhaustible are they?

First, let us consider coal. To begin with our best quality coal, upon which so many of our communities are now dependent, comes from outside of Canada; and to-day we are feeling the significance of this. Even in many places in New York State there is a present shortage, and with the most friendly relations existing between the two countries we must realize the justice of the old saying that charity begins at home. If Ontario is now pinched for fuel what might the situation become if the United States found it necessary to seriously curtail export or if for any reason the friendliness of the United States were denied us in this matter.

That seems to throw us back on our own resources, therefore—our water powers; and what is the situation? To-day Ontario especially is crying out for more electric power; established industries are being curtailed in their supplies; the load is being jockeyed at the peak period to enable the essentials to carry on, and the general public is being importuned to economize and turn off, where possible, even a light or two.

It is thus no idle statement we make regarding the importance of the annual meeting of the Commission of Conservation, for they are studying this very problem. One of the most interesting and, at the same time, most important papers presented was that by Mr. Arthur V. White, M.E., consulting engineer to the Commission, on the subject of the conservation of our water powers. Time and again in recent years the attention of the public has been directed by this Commission, chiefly through Mr. White's writings, to the imminence of a condition that the war has simply hastened. Most of us were taught, in the early days, that the water powers of Canada existed in such abundance that their value was questionable and their conservation unnecessary. How foolish and narrow this viewpoint was we are now realizing, when we have it thrust upon us that our commercial stability and expansion depends upon whether we can get more power.

Mr. White, in his paper, again refers to the seriousness of the coal situation, the present shortage of electric power, the possibilities of development on the St. Lawrence River and particularly the paramount importance of conserving, for use in Canada, every single unit that belongs to us, either for direct use of Canadian citizens or, it may be, for exchange on an equitable basis for coal or other commodities which may be indispensable to Canada at some future date.

In other words, shall we have the bank account or shall we hand it over to the "other fellow?"

There is no hysterics about it—just a fair statement of actual facts. These facts, printed elsewhere in this issue, should be read and digested by every Canadian citizen.

Shall We Commit Commercial Suicide?

It is most unfortunate that at a time when a common danger should, naturally, unite the people of Canada, so that we may concentrate all our forces against a common enemy, that there should be so much of bitterness, so much useless expenditure of physical energy of which we and our allies possess all too little for the tremendous work in hand. The reports of present Canadian conditions distributed widely from day to day throughout Germany, as undoubtedly they are, will act like a tonic to their lagging spirits and give them fresh heart, just as conditions in Ireland and Russia have done, to fight on. One can easily imagine with what satisfaction the Kaiser is watching our campaign, well knowing that every dissension here is a positive gain for him.

But aside from all this, the people of Canada should sit down quietly and consider what our commercial position would be if Canada should decide to become a "neutral"—for that, in effect, is what a defeat of the Union Government would mean What would England's attitude become? What that of the United States? Let us remember that the orders which have given Canada the greatest commercial activity in her history came from the Mother Country; would they come to neutral Canada? Let us remember that we are dependent to-day upon the United States for raw materials, the withholding of which would mean widespread industrial depression; and judging by the United States' attitude toward other neutrals, would they not be withheld?

Quite aside from all sentimental arguments, will it not be the part of wisdom for us to consider well, before Canada, as a nation, decides to commit commercial suicide?

Effect on Employees of Various Hours of Labor

The British Ministry of Munitions early in the war appointed a Health of Munition Workers' Committee to investigate, among other matters, the effect, upon both the health and the output of the employee, of various working conditions and various lengths of working days. The latest report of this Committee extends over a period of more than twelve months and points some fairly definite conclusions:

"One set of observations relates to a group varying from 95 to 80 women turning aluminium fuse bodies. Their average hourly output, taken as 100 for the month before Christmas, 1915, during which they worked an average of 66.2 hours a week, rose ultimately in the next twelve months to 158, by which time the hours of work had fallen to 45.6; there was therefore an increase of 9 per cent. in gross weekly output in spite of—or perhaps more truly because of—working 20.6 hours fewer a week. The work was done on capstan lathes with seven tools. A group of 40 women on threadmilling in semi-automatic machines, starting in the pre-Christmas period with a week of 64.9 hours, increased the hourly output after 11 months to 133, the hours of work falling to 48.1; so that the gross weekly output was within 1 per cent. of the November-December output, though 16.8 hours fewer were worked in the week. Another group of 56 men sized fuse bodies by screwing them through a die; and the dies in the previous operation seem to have been rather worn, or the work left rather full in diameter, as the job, when Dr. Vernon inspected it, struck him as heavy labor imposing a great strain on the workers. Here the average November-December hours were 58.2, and in the following December the hourly output had risen to 139 against a reduction of hours to 51.2, the gross weekly output thus being 22 per cent. more than at the start for seven hours a week less work. A small group of 15 youths, again, were boring top caps in semi-automatic machines, and worked 72.5 hours a week at the start, falling by July-September to 54.5 with an hourly output of 129; their gross weekly output, with 18 hours' less work, was 3 per cent less than with the longer hours."

These figures appear to bear out the contention of many Canadian manufacturers that, except over a very limited period, the output during longer hours is by no means proportionate to the number of hours worked. No doubt the conditions under which employees work will influence the length of time over which they can maintain maximum efficiency and no doubt also different individuals are differently constituted. In the main, however, these figures point the conclusion that more can be accomplished working at high pressure for a certain shorter period than by any other arrangement. Just where to draw the line can only be determined by [illegible], and will vary no doubt with the [illegible] [illegible]. It [illegible] limited [illegible] [illegible] [illegible] research [illegible] most scientific nature.

Montreal Aqueduct Scheme Shelved

The much-criticised Montreal aqueduct scheme may be regarded as dead. The contract with the Cook Construction Company is, according to a decision of the Board of Control, to be cancelled and the claims and counterclaims referred to arbitration. It will be recollected that the chief part of the criticism was directed to the portion of the scheme having for its object the development of hydro-electric power for pumping and lighting purposes. Some of the most eminent engineers in Montreal attacked the scheme in very strong terms, it being criticised as unlikely to produce the horse power claimed; also that serious operating trouble due to ice were inevitable; and that the cost per electrical horse power would be very excessive. It was recommended that all thought of completing the project on the lines suggested should be abandoned, and the balance of power required be purchased or generated by steam power. The city made a vigorous reply to these attacks, claiming that they were unfounded, and that it would be more economical to complete the work than to abandon it, after having spent so much money on the scheme.

As a result of the criticisms, the Council appointed a Commission consisting of Messrs. H. A. Vautelet, A. St. Laurent and John B. McRae, who reported in favor of a modified scheme, giving 13,000 h.p. for pumping purposes, which would also involve the construction of a steam plant. There was, said the report, no power in sight to enable the city to take over its own lighting.

At the arbitration Mr. W. F. Tye, M.C.S.C.E., will represent the Cook Construction Company; Mr. J. M. R. Fairbairn, M.C.S.C.E., the city, and Mr. Aime Geoffrien will act as third arbitrator. The city have agreed to waive a claim of $900,000, the estimated cost to complete the work if the company abandoned the contract.

The reason for the cancellation of the contract is that financial conditions, due to the war, are such that it is impossible to proceed with such enterprises for a year or two. Besides, the cost of labor and materials has so advanced that it is not an economical proposition to go on with the work.

The truth is, that the scheme is likely to prove so costly that the Board of Control are anxious to shelve it, particularly in view of the tangle of Montreal's finances and the heavy claims of the Cook Construction Company.

Moose Jaw's Annual Report

The administrative commission of the city of Moose Jaw, Sask., consisting of W. W. Davidson, Mayor, and Geo. D. Mackie, city commissioner, have issued a report for the ten months ending October 31, 1917. A condensed statement of the revenues and expenditures of the electrical department shows a total revenue of $161,217, and a total expenditure of $160,495, leaving a balance net profit of 0722. This compares with a profit of $4,853 in 1916. The decreased surplus is stated to be almost entirely due to the increased consumption of fuel owing to the generator plant being in a bad state of repair. The reason for this is that the necessary repair parts have not been obtainable from England, but it is hoped that these difficulties will be remedied at an early date. The increase in the cost of labor and supplies has also had some effect in reducing the surplus.

"The total output of the plant was 5,013,590 kw. hours, as compared with 4,295,070 kw. hours for 1916, being an increase of 16.7 per cent. The number of consumers at October 31 was 3,930, as compared with 3,612 in 1916, an increase of 318 or 8.8 per cent. It is a gratifying feature of the operation for the year that the average load has increased, the average being 687.2 kilowatts as against 587.6 kilowatts for

THE ONE CHOICE

By Edgar A. Guest

Taking the bad with the good, taking the good with the bad,
Clinging to faith in our sorrow, living the days that are glad,
Blindly we follow the pathways mapped out for all mortals to tread —
This is the battle called living, and nobody knows what's ahead.

The goal of our strife isn't told us, we know not what waits at the end,
Nor the length of the journey we're making nor how many years we shall spend;
As soldiers who go into battle aren't told of its purpose or plan,
So we come to this world under orders to take up the labors of man.

We are here, and it's not of our choosing, nor the ultimate goal may we choose,
We shall learn from the Master who sent us the final result of life's cruise;
But we have one choice that's unhampered, servants we are and yet free—
We may choose from life's good and its evil, we may say what the soul is to be.

It isn't for us to determine how long we shall live, but how well;
The purpose of life and its struggle is something no mortal can tell;
We can choose not our coming or passing; that summons the Master must give,
But each, to his fancy or thinking, may pick out the way he shall live.

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1916, an increase of 16.9 per cent. The peak load this year was 1,700 kilowatts, which gives a load factor or proportion of the average load to the peak load of 40.4 per cent. The load factor for 1916 was 34.7 per cent. and for 1915, 30.4 per cent. The average cost of production and distribution per kilowatt hour generated was 3.206 cents, as against 3.235 cents last year; and the revenue received per kilowatt hour generated was 3.223 cents, as against 3.389 cents for 1916. This goes to show that the increased output this year is mostly due to the day load which is used for power, cooking, etc., and which forms the most desirable business of the plant. The cost of fuel per kilowatt hour generated amounted to 1.142 cents, as compared with .924 cents last year.

Street Lighting

"The cost of street lighting was $19,286.63, as compared with $17,250.86 last year. This increase is almost entirely due to the increased cost and poorer quality of the arc lamp supplies as the manufacturers of these supplies were evidently dependent on enemy countries for their supply of raw materials, and were compelled to adopt expensive substitutes. The question of increasing the number of street lamps in the city has been before the council from time to time, but owing to the high cost of installation it has been deemed inadvisable at the present time to increase the number of these lamps. It is nearly impossible to obtain arc lamps for street lighting purposes, and the council have at present before them a report from the electrical superintendent as to whether it would not be advisable to abandon the present arc lamp system of street lighting. Although it is only a few years since these lamps were developed they have been outclassed for efficiency and service by the more modern nitrogen filled incandescent lamp, and it has therefore been considered advisable to defer the purchase of any lamps until sufficient funds are available to convert the present arc lighting system into the more modern, efficient and satisfactory nitrogen filled incandescent system."

Illumination at the Electric Club

The attendance at the midday luncheon of the Electric Club of Toronto on December 7, contained a generous sprinkling of architects—the occasion being a talk by Mr. E. N. Hyde, Montreal, on "Illumination." Toronto electrical men are always happy in welcoming Mr. Hyde and on this occasion the members turned out "en masse" to hear him. Unusually interesting was his demonstration of the variable illumination effects procurable by changing the direction, intensity and color of the light incident upon an object. For the purpose of obtaining these variations, Mr. Hyde had brought with him from Montreal a quantity of material and had set up in one corner of the room a small dark room equipped with lamps in different positions, color screens, switching interchanges, resistances, etc. Demonstrations were given on the illumination of panels, columns, art screens, etc., and, one particularly convincing, with a live model. In this case the change was so startling as to give one the impression of entirely different individuals.

The moral Mr. Hyde drew from all his demonstrations was that by a more intimate co-operation between architect and illuminating engineer, many of the present-day anomalies which pass for illumination would be avoided. The architect must first be brought to realize the possibilties of increasing the effectiveness of his work by lighting it better. He must in turn learn to look to the illuminating engineer for co-operation, and finally, the engineer must be sufficiently master of his business to accomplish the desired result efficiently and economically. It may safely be said that Mr. Hyde's talk will go a long way towards bringing about these much to be desired conditions.

The luncheon on December 14 will be the last until after the Christmas season. Mr. Z. A. Lash, K.C., president Great North Western Telegraph Company, will speak on "Courts of Law and Equity in Canada." Mr. E. I. Jenking is occupying the chair during December.

The Laurier View

"We do not see how the Canadian volunteers died for us when this country was in no danger. Our soldiers died for England and for France and not for us. . . . . The blood of our soldiers shed on strange soil was for a cause foreign to our own, and consequently will bring no fruit for Canada."—Le Droit, Ottawa.

And This Also

"Are the people of this country going to place at the head of affairs a man (Borden) who will be precipitated into such a position as this, who will take from the treasury of this country and who would have taken enough money to build two Dreadnoughts and send them to England so that they could spend it as they pleased? And against what country? He was ready to send money to build warships to fight Germany.

"How are the Germans of this country going to stand behind him when he is supporting a man who is taking that stand in regard to the defences of the Empire?"

A large number of the delegates were of German descent, and they loudly applauded.—Toronto Globe (Liberal).

This is the report of a speech delivered by Hon. Mr. King—Laurier's representative—in Berlin (now Kitchener) in 1911.

THIS SAME KING IS TO-DAY A LAURIER CANDIDATE IN NORTH YORK, ONTARIO.

Montreal Electric Luncheon Club

Mr. H. A. Lordly, provincial secretary of the Canadian Boy Scouts, was the speaker at the Montreal electrical luncheon on December 5. In a very clear manner, he explained the origin of the movement, and told of its extension to every part of the civilized world, and, he added, Germany. The movement was essentially one making for good citizenship, had passed through the stages of ridicule and admiration, and was now in that of world-wide acceptance—an extension which was never dreamed of by Sir Robert Baden-Powell, the originator. The movement was neither military nor religious, neither was it an attempt to turn out military scouts. The boys had to pass a number of tests, and were able to obtain proficiency badges—the total was 53—for elementary knowledge in a very wide series of subjects, including electricity, carpentry and other trades, cooking, ambulance work, typing, canoeing, all designed to make members better citizens and useful to the community as well as of benefit to the boys. The members had to subscribe to ten laws, the most important being the pladge of honor. The boys were able to obtain war service badges, and in Montreal alone they had put in 29,700 hours on work associated with the war. Between 800 and 1,000 ex-members had gone overseas. There were mistaken ideas as to the real motives underlying the movement, which were to train the boys into useful members of the community.

The Navy League of Canada

"The Navy League and its Relation to the British Navy" was the subject of an address by Mr. C. W. Trenholme, general secretary of the Navy League of Canada, at the Montreal electrical luncheon on November 28. Mr. Trenholme briefly traced the chief naval events since the beginning of the war, pointing out how the participation of Great Britain in the conflict had upset Germany's plan for a supreme naval attack on France in the Mediterranean. The action of the British Navy had compelled Germany to keep her fleet in hiding, had rid the seas of commercial raiders, and had destroyed Germany's overseas trade. The Navy had also protected Canada's coasts, enabled 350,000 men to be carried across the Atlantic without the loss of a man, kept open the channels for Canadian commerce, allowed this country to send enormous supplies of food and ammunitions, and also protected our sick and wounded on their return to Canada. Another result of the efficiency of the navy was to bring prosperity to the Dominion. If any great reverse were to happen to the British Navy there was nothing between Canada and disaster. Mr. Trenholme then outlined the objects of the Canadian Navy League, which is affiliated to the British Navy League. The main object is to see that Great Britain holds command of the seas, but the League also secures funds for the benefit of the sailors of both the mercantile and naval branches of the service.

Prior to Mr. Trenholme's address, Mrs. G. T. Hodge spoke briefly on behalf of the Institution for the Blind, Montreal.

Electricity Causes Few Accidents

While serious accidents to linemen of public utility companies are often caused by electric current, it has recently been found from an analysis of nearly 6,000 accidents among this class of employees that less than 12 per cent. of the total number of serious accidents is caused by electricity, and that a very large proportion are the result of carelessness. The following is a detailed analysis of 6,000 accidents occurring to linemen only. It will be noted that nearly 20 per cent. of the accidents occurred from falling bodies, while accidents due to electric current are given as 11.4 per cent.:

	Per cent.
Striking or struck by material	18.8
Electric current	11.4
Wire, glass, sharp edges	10.0
Handling tools	9.4
Struck by falling bodies	9.4
Lifting or moving material	9.4
Falls from pole	7.3
Acid, solder, or compounds	6.0
Fall from elevation (other than poles)	6.0
Fall on level over material	5.4
Injured by spurs	4.0
Fall from vehicle	2.0
Run down by vehicle	0.7
Injured by animal	0.7

Ontario Hydro Enlarging Niagara Plant

The Hydro-electric Power Commission of Ontario are going ahead with the construction of a new pipe line at Niagara Falls, running from the intake to the generating station, and paralleling those now in operation. It is expected this line will be completed by July, by which time also it is the intention to have extra turbine and generating equipment to the extent of some 25,000 h.p. ready for operation. Whether this will be in the form of two units similar to the latest additions to this power house, or whether one large unit will be installed, has not yet been determined.

Looking Backward

The following interesting letter from one of our readers, in response to our request for an expression of opinion on the business outlook of the near future, appears to us to hit the nail pretty squarely on the head. After all, the big thing is that we should so conduct ourselves to-day, that after the war is over and we all have time to sit down and take an inventory, Canada shall feel no shame and no regret at the course she has followed:—

> **"There is no cloud on the commercial horizon at present. Of course the future state of business depends largely on the duration of the war and the extent of our participation in it. If we do our duty—and I think we will—we shall put all our resources into winning the war. If we do this it might mean that some now essential industries would have to be re-equipped to take care of essentials.**
>
> **"I make the prediction that we will all be in government service 'ere long, either serving at the front or at home, that all profits will be cheerfully eliminated in the interest of the state and that we who cannot serve overseas will be serving at home doing the thing we are best qualified for, cutting out luxuries, increasing the supply of, and saving food stuffs, and generally equipping ourselves to be worthy of a place in the front of the Empire and worthy of the boys who have given their all for us.**
>
> **"In keeping the home fires burning, every patriotic manufacturer will keep his business in such flexible position that he can serve the government in such requirements as they may need and at the same time keep his regular line of business organized and alive so that immediately the war is over he may be able to employ the boys who return, in their regular occupation.**
>
> **"There is need and use at home for every person who is able to work to take the places of those who are to serve in the present draft, and will be so long as we do not show any yellow streaks.**
>
> **"We need not worry at present about business; all of our concern needs to be whether or not the nerve of Canada is going to match the nerve of our Allies. If it does, Canada will remain on the map as a great nation in the building. If it does not, we will join 'No Man's Land.'"**

Work for Blind Soldiers

The Crocker-Wheeler Company, of Ampere, N.J., have recently started a department where blind people are utilized in the winding of wire coils for armatures and similar devices and the insulation of the wires by wrapping them with tape. This department has been in operation for about two months, and there are now twenty blind people working there, three of whom are women. It is claimed that the blind workers are quite as proficient as the employees who formerly did this work and possibly produce better results, in that their sense of touch has been very highly developed. The company feel that in this work there may be a very considerable opening for the soldiers who return from the war afflicted in this way.

The Power of the St. Lawrence Rapids

Shall we use it ourselves or hand it over to foreign interests? Ontario "marks time" today owing to power shortage

By Arthur V. White, M.E.*

It will be ten years next May since the conference of governors called together by the President of the United States held its memorable meeting in Washington, and as a result of which the Commission of Conservation of Canada was constituted.

Policies adopted at this Washington conference and subsequently carried into effect have markedly affected not only the United States, but also Canada, and, indeed, the world at large. It was so clearly demonstrated that several of the chief natural resources of the United States were within measurable distance of exhaustion that prompt action by the trustees of the nation was imperative.

Addressing the conference, the President of the United States said:

> "This nation began with the belief that its landed possessions were illimitable and capable of supporting all the people who might care to make our country their home; but already the limit of unsettled land is in sight, and, indeed, but little land, fitted for agriculture now remains unoccupied save what can be reclaimed by irrigation and drainage. . . . We began with an unapproachable heritage of forests; more than half of the timber is gone. We began with coal fields more extensive than those of any other nation and with iron ores regarded as inexhaustible, and many experts now declare that the end of both iron and coal is in sight. . . . The enormous stores of minerals, oil, and gas are largely gone. . . . Our natural waterways are not gone, but they have been so injured by neglect and by the division of responsibility and utter lack of system in dealing with them that there is less navigation on them now than there was fifty years ago. Finally, we began with soils of unexampled fertility, and we have so impoverished them by injudicious use and by failing to check erosion that their crop-producing power is diminishing instead of increasing. In a word, we have thoughtlessly, and to a large degree unnecessarily, diminished the resources upon which not only our prosperity but the prosperity of our children and our children's children must always depend."

The Commission of Conservation of Canada has been endeavoring to have the natural resources of the country developed in a manner which will, so far as possible, pass them on to succeeding generations unabused by the uses to which they must now necessarily be applied. In this connection special attention was devoted to the beneficial use and conservation of Canada's water resources, and some of the earliest activities of this commission consist of investigations respecting the character and extent of the water-powers of Canada. In presenting the results of their research, the commission, from time to time, has advised respecting such subjects as water-powers development, the improvement of navigable rivers, the necessity for protecting against damage by flood, the preservation of soils against erosion, the conservation of underground waters, as well as upon other matters related to our water resources.

Some resources, such as minerals—perhaps more especially coal, oil, and gas—if used, must, in time, necessarily become exhausted. On the other hand, such resources as the soil, plant growth, waterways, and ground waters, may be conserved; and, just as a good husbandman passes on his farm in an improved condition to that in which he received it, so the policies advocated by this commission have been directed to the passing on to succeeding generations in an improved condition the heritage of the natural resources of [illegible]

St. Lawrence River Powers

We are now briefly to consider, chiefly in its economic aspects, one of Canada's great natural assets—the water possibilities of the St. Lawrence River.

The water-powers of this river, as yet, are largely within the control of the people. There is, however, a shortage of hydro-electric power which is being keenly felt, both in Canada and the United States, and at present strong efforts are being made by private interests to obtain control of the enormously advantageous power in, or adjacent to, the international boundary.

The city of Montreal and vicinity is, for a time at least, well supplied with electric energy, but, comparatively speaking, the rates are high. If more energy were available—as could be the case—at considerably lower rates, electric power and light would be much more extensively used both in factory and home.

Power Shortage in Eastern Ontario

There has been great shortage of power for supplying municipalities in Eastern Ontario. At the present time the Hydro-Electric Power Commission of Ontario have urgent requests from such municipalities as Brockville, Prescott, Winchester, Chesterville, Cornwall, Mille Roche, Smith's Falls, Perth, Carleton Place, Kemptville, and Almonte, for electric power to take care of connected loads aggregating from 15,000 to 20,000 h.p., with a present peak load of not less than 8,000 h.p.

Although Eastern Ontario has not been so extensive a manufacturing centre as Southwestern Ontario, nevertheless it is well to recall that in the fall of 1910, when the Hydro-Electric Power Commission of Ontario commenced operating its Niagara system, it was supplying only about 8,000 h.p. On this system alone it is now—in the fall of 1917—supplying more than 100 municipalities, taking over 200,000 h.p., and, in addition, some 50,000 h.p., is supplied in the Niagara district to munition plants.

The power shortage in Eastern Ontario of late has become acute. It had been hoped that power would have been available from the large development at the Cedars on the St. Lawrence River, but this power, although conveyed through the territory of the municipalities requiring power, was taken en bloc to the works of the Aluminum Company of America, situated at Messina, N.Y.

From time to time it has been suggested that some of this power might be brought back from Messina to Canada for supplying the needs of Canadian municipalities. This, however, has not been done, but, instead, distributing systems have been established for supplying, from Messina, various municipalities in the northern part of the State of New York. Great industrial advantage has followed the utilization in the United States of the electrical power generated in Canada at "The Cedars," on the St. Lawrence River, and exported to Messina, N.Y.

During recent hearings, conducted by the Committee on Foreign Affairs of the United States House of Representatives at Niagara Falls, N.Y., and elsewhere, one point which was prominently emphasized by representative citizens was that the United States could not afford to permit industries to go outside of the country and locate in other countries where cheap power was being offered; and it was emphasized that industries requiring large blocks of power were often compelled to go to places where the power could be had. The United States has already lost industries to Norway and to Canada.

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*[illegible] to the Commission of Conservation, before the [illegible]

There is very strong opposition, especially throughout Ontario, to any policy which permits the exportation of Canadian electrical energy required for use in Canada. The Federal Government was memorialized upon this subject. It has been urged that no large power projects, such, for example, as those on the international portion of the St. Lawrence River should be developed without reserving, for use in Canada, her share of the power; and, further, that such power as exists wholly in Canada should be reserved against the day of Canada's need.

If power is developed, as is proposed, for example, at the Coteau Rapids, it is much more important that it be available for supplying the needs of such municipalities in Quebec and Ontario as would naturally be served from such power than that the power be exploited by private interests, or exported and employed to build up industries in the United States.

The proposal to which I refer is that of the Power Development Company, Limited, who are applying for the rights of power development at the Coteau Rapids.* The Commission of Conservation and other organizations are opposing the project.

Coal Situation

As never before, the public interest has been aroused respecting both its fuel supply and its increasing dependence upon hydro-electric energy. The central portion of Canada depends for its coal upon the United States. The present war conditions are going to drive home to Canadians as never before the tremendous gravity of their position with respect to fuel. If large quantities of electric energy be available at sufficiently cheap rates, it will doubtless be much more extensively employed for certain heating and other domestic uses now served by coal. Precaution must be taken, however, to ensure absolutely against wasteful uses.

Specific statements respecting the coal situation, especially in its broad national bearing, are published in my earlier reports. In 1910, referring to this subject, I used the following words, which are equally true to-day:

> "Certainly the people of Canada are in better circumstances to maintain a supply of heat and power if their water-powers, including their full share of international water-powers, are reserved to themselves and not permitted to be exported except upon terms and conditions which will conserve absolutely the present and future interests of the citizens of Canada. Not only would the water-powers of Canada provide, to a certain extent, a substitute for the coal supply of the United States as a means of furnishing light and heat and power, but control of these water-powers would secure a basis upon which negotiations for coal could be conducted in a possible day of need. Canada would be in a position to exchange, if need be, part of her electric energy for part of the coal supply of the United States. It is obvious, however, that if the United States interests should control both the coal and the water-powers the situation of Canada would become exceedingly grave."†

I shall not here enlarge upon the coal situation, but shall deal more particularly with the power situation and the shortage of hydro-electric energy.

Concentration of Control

Most of the water-powers which are more readily capable of economic development in Canada, as well as in the United States, either have already been developed or are privately controlled. Concentration of ownership is a noticeable feature of this control. It has been authoritatively published that in the United States, in 1913, about 6,300,000 h.p. was controlled by ten groups of interests. This concentration is still going on. Owing both to provincial and federal legislation it has not been possible for interests so readily to obtain control of water-powers in Canada. Efforts, however, are continually being made to secure the rights for such desirable water-powers as are yet vested in the state. The efforts made by the powerful financial interests behind the Long Sault Development Company to obtain control of the almost unequalled power rights at the Long Sault Rapids, on the St. Lawrence River, are still in mind.

The public cannot be too well informed respecting the extent to which they may be compelled to pay tribute to those concentrating hydro-electric powers, by reason of the control which such interests have over the distribution and supply of electrical energy. Referring to this concentration of control, Mr. Gifford Pinchot has stated:

> "And whoever dominates power dominates all industry. Have you ever seen a few drops of oil, scattered on the water, spreading until they formed a continuous film, which put an end at once to all agitation of the surface. The time for us to agitate this question is now, before the separate circles of centralized control spread into the uniform, unbroken, nation-wide covering of a single gigantic trust. There will be little chance for mere agitation after that. No man at all familiar with the situation can doubt that the time for effective protest is very short. If we do not use it to protect ourselves now we may be very sure that the trust will give hereafter small consideration to the welfare of the average citizen when in conflict with its own."

Respecting the water-powers of the United States and the attempt to create a monopoly of same, Mr. Roosevelt, when President of the United States, in accurate prophetic terms stated:

> "The people of this country are threatened by a monopoly far more powerful, because in far closer touch with their domestic and industrial life, than anything known to our experience. A single generation will see the exhaustion of our natural resources of oil and gas, and such a rise in the price of coal as will make the price of electrically transmitted water-power a controlling factor in transportation, in manufacturing, and in household lighting and heating. Our water-power alone, if fully developed and wisely used, is probably sufficient for our present transportation, industrial, municipal, and domestic needs. Most of it is undeveloped, and is still in national or state control. To give away without conditions this, one of the greatest of our resources, would be an act of folly. If we are guilty of it, our children will be forced to pay an annual return upon a capitalization based upon the highest prices which 'the traffic will bear.' They will find themselves face to face with powerful interests, entrenched behind the doctrine of 'vested rights' and strengthened by every defence which money can buy and the ingenuity of able corporation lawyers can devise. Long before that time they may, and very probably will, have become a consolidated interest, dictating the terms upon which the citizen can conduct his business or earn his livelihood, and not amenable to the wholesome check of local opinion."

This prophecy of the ex-President is daily in process of fulfillment. Canada cannot afford to have her St. Lawrence River powers pass into the hands of powerful private interests.

Inconveniences of Curtailed Output Reduced By Contract Stipulations

There has been a marked general tendency to exaggerate the quantities of water-power which may be developed. For tentative estimate of the power of the St. Lawrence we shall assume that practically the full low water flow of the river would be available for power development.

If large power development should take place in the St. Lawrence River, considerable quantities of the electrical energy would, for a time at least, probably be utilized by electro-chemical industries. The tendency of vendors of electrical energy, in contracts with such large power-users as the electro-chemical industries is to stipulate that such customers must curtail consumption at times when there is depletion in the generated supply owing to unavoidable causes. By means of such contract arrangements the requirements of municipalities and of industries requiring smaller amounts of power continuously may be safeguarded.

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*Re application to the Dominion Government made under the Navigable Waters Protection Act—R.S.C., chapter 115, see "Canada Gazette" for September 22, 1917, p. 969.

†Respecting various phases of this subject, consult an article by Arthur V. White on the "Exportation of Electricity," which appeared in the "University Magazine," October, 1916, pages 160 et seq. Consult also "Toronto World," 18th March, 1912; also "Exportation of Electricity - An International Problem: Relation of a Possible Coal Embargo by United States to a Curtailment or Stoppage of Canada's Electric Power," in the "Monetary Times" of January 5, 1917, pages 21 et seq. Consult also "Annual Reports of Commission of Conservation," Ottawa.

Possible Power Sites

On the St. Lawrence River, below Lake Ontario, the first site where a power development could be made is in the vicinity of Morrisburg. With a dam near the foot of Ogden Island, a head could be obtained of about 11 feet, or if a portion of the Galop Rapid were included, possibly an effective head of about 15 feet could be obtained. If utilization of the Galop Rapid be contemplated, then the question of regulating works to control the level of Lake Ontario becomes an important factor. In fact, for power developments on the St. Lawrence the regimen of flow from, and storage in, each and all of the Great Lakes must be taken into consideration.

The next possible development is that at the Long Sault Rapids, where a head of about 35 feet may be created. The head which may profitably be developed at this point has, by some engineers, been estimated at less than 35 feet; others estimate that it might be increased to about 40 feet.

Descending the river, we have next, in a stretch of about 14 miles between Lake St. Francis and Lake St. Louis, three series of rapids—the Coteau, the Cedars, and the Split Rock and Cascades. At the Cedars the Cedars Rapids Manufacturing and Power Company have constructed a large power plant, to which additions are now being made, and which, ultimately, will utilize, by diversion, 56,000 second-feet.

The Cedars Rapids Company utilize a head of about 32 feet, developed by means of a diversion canal some two miles long. The power-house at the foot of the canal is designed for an ultimate development of 180,000 h.p. At present units aggregating some 100,000 h.p.. are installed. Extensions for two additional units are now being made. This company is exporting to the United States over 65,000 h.p., which is used in the plant of the Aluminum Company of America at Messina, New York State.

Coming next to the Lachine Rapids, below Lake St. Louis, we have a head of about 30 feet in four and one-half miles. Here about 17,000 h.p. have already been developed. The total undeveloped possibilities of the river at this point may be estimated at about 400,000 h.p.

What 65,000 h.p. Could Do

Few people have any conception of what the 65,000 h.p. now being exported to the United States by the Cedars Company would mean if widely distributed to customers of light and power, such as are found in our cities and towns. For instance, the Toronto Hydro-Electric Commission, supplying both light and power to over 40,000 customers, up to the end of 1916 met requirements with a little less than 50,000 h.p. The rates for light and power in Toronto are low, much lower, for example, than in Montreal. Including the requirements of the Toronto Street Railway, Toronto Electric Light Company, and the Toronto Hydro-Electric Commission, there is now required for light and power in the municipality of Toronto about 120,000 h.p..

It may be said, therefore, that the 65,000 h.p. exported to the State of New York from the Cedars could supply, at cheap rates, all the light and power required by a representative manufacturing city of 300,000 or more inhabitants, or would supply light and power to upwards of 35 average manufacturing cities of 10,000 inhabitants each; or it would take care of one-third of the present operations of the Ontario Hydro-Electric Commission in its Niagara system, which supplies over 100 municipalities and over 100,000 customers.

When the benefits resulting from power thus widely distributed are contrasted with the localized benefits from the same power utilized in bulk, as in the electro-chemical industries, it will be perceived how much more the former than the latter contributes to the upbuilding of communities and the growth of the country at large.

Is it surprising that the former United States Secretary of War, Hon. Henry L. Stimson, stated, respecting Niagara power, that:

> "The investigation [re power at Niagara Falls] which has been made by the engineers indicates that Canada, if we do not take it, will use the entire amount that the treaty permits in a very brief time, . . . and it would result in giving to Canada, very possibly, a large number of industries which otherwise would be established on this side of the falls."

In a report to the chief of engineers, United States army, Lieut.-Col. J. C. Sanford states:

> "If advantage of power generated in Canada cannot be had on the American side, manufacturers will be attracted to Canada by this cheap power, and the industries of this country [the United States] will suffer accordingly. The effect of present restrictions on the importation of power is becoming noticeable. . . . Manufacturers at present contracting for additional Niagara power must locate, and are locating, in Canada."

The sub-committee on Niagara Falls power, appointed by the United States House of Representatives Committee on Foreign Affairs, states that it had been urged for its attention:

> "That the Canadian companies were rapidly increasing their sales and would very soon take the full amount of water they were entitled to and the United States ought to get what power it was able to **now.**"

And they add:

> "If the advancement in the development of power on the Canadian side increases for another year or so—and it is not apparent to the committee that it will not—then the committee concluded that it was proper to take as large an amount as it could get for consumption in the villages, cities, factories, and homes along **our** border."

Now, if, after giving full and just consideration, in its international aspect, to the vital subject of Canada's coal supply, it is found that the electrical energy generated in Canada can be retained for use in Canada, then highly beneficial results will be achieved which are unobtainable if the electricity is exported to the United States.

Summary of Power Sites

In summarizing the St. Lawrence water-powers, we may estimate the low-water power of the portion of the St. Lawrence River which is traversed by the international boundary, at about 800,000 h..p., of which Canada is entitled to one-half, or 400,000 h.p.

The amount of power which lies wholly within Canada would be about 1,400,000 h.p. This, with its share of power along the international boundary, makes an estimated total for Canada of 1,800,000 low-water continuous horse-power.

It may representatively be detailed as follows:*

Water-Power on the St. Lawrence River

(Tentative schedule.)

Site	Maximum head available Feet.	Maximum estimated low water 24 hr. horse power	Average estimated 24 hr. low water h.p. (say).
1 Morrisburg Rapids Flat	15	230,000	200,000
2 Long Sault Rapid	40	650,000	575,000
3 Coteau Rapid	17	260,000	250,000
4 Cedars Rapids	32	525,000	500,000
5 Split Rock and Cascades Rapid	18	280,000	250,000
6. Lachine Rapid	30 (2)	450,000	375,000
Total . .		2,395,000	2,150,000

*In this table some allowances have been made for efficiency and other factors, in order to have the estimates fairly representative of the possible quantities which might be expected under representative low-water flow conditions.

(2) Under development for about one third of the low water flow of the river. Consideration would be given to the possibility of combining Sites Nos. 3, 4 and 5, also of increasing No. 6

Owing to the fact that vendors of power are able to adjust their deliveries, it is frequently possible to sell power which, during other hours, is used by another consumer. Thus, by way of example, the Hydro-Electric Power Commission of Ontario, by taking into consideration what is technically known as the "diversity load factor," can, I understand, supply contract requirements of 320,000 h.p., with a power capacity of 250,000 h.p.; therefore, assuming such a basis for the St. Lawrence River powers, Canada's 1,800,000 h.p. would take care of a power demand of some 2,400,000 horse-power.

The Ice Menace

In passing, permit me just to state that power development on the St. Lawrence River cannot properly be considered apart from the subject of the ice menace. In the special report dealing with the Long Sault power project[*], attention is drawn to the great menace which exists in the ice conditions manifested in the St. Lawrence River.

Too great caution cannot be exercised before attempting to harness natural forces of such magnitude as exist in the flow of the St. Lawrence River—a too radical disturbance of the balance which Nature seeks to maintain may evoke disaster. These aspects of the problem of power development in the St. Lawrence are here emphasized, because they involve the weighing of basic physical factors of paramount importance.

Toronto Hydro-Electric Commission

In concluding, I shall briefly refer to one or two phases of the present power shortage and the rapidly increasing demand for electric energy.

The Toronto Hydro-Electric Commission, which obtains power through the Hydro-Electric Power Commission of Ontario, and distributes light and power to Toronto, commenced operations on June 1, 1911, with about 400 customers. At the present time—November, 1917—there are over 50,000 customers. To take care of this business has necessitated an outlay on the part of the municipality of Toronto of about $8,000,000. The operations of the commission, taking care of the 1917 December load, will, it is expected, require about 75,000 h.p. At the present time only about 50,000 h.p. is available. The Toronto commission is exerting every effort to compress its load and to hold back even the natural increase in the requirements of its present customers. It can take on no new customers, and of late has been issuing special appeals to present customers "to use as little current as possible until further notice, particularly from 4.30 to 6 in the afternoon on Mondays, Tuesdays, Wednesdays, Thursdays, and Fridays, and so help to avoid a possible shortage for munition plants and other essential industries. The commission states that:

> "Every economy, however small, will help to achieve the result aimed at. If each of the 50,000 Hydro customers in Toronto uses even one or two lights less during these hours it will mean a greater reduction than though the whole of the street lights in Toronto were turned off."

There is no doubt that a great deal of power and light are needlessly wasted. There was a time—and not very long ago—when the vendors of electrical energy were offering special inducements to encourage consumption, and customers were invited to use new electric devices as rapidly as such could be invented. The public has responded to these invitations, and now—assuming that there is not a set-back to industrial activity—Ontario is faced with a power shortage which, until relieved, must constitute a serious check to her industrial growth.

Power for War Munitions

The Hydro-Electric Power Commission of Ontario at present requires for munitions an additional 140,000 h.p. This, however, they are not able to supply. Including the contract with the British Forgings, Limited, the commission at present is under contract to supply about 95,000 h.p.

The average individual has little idea of how diverse and extensive are the demands upon manufacturers for materials of war. A recent photograph shows a French soldier at his post with such individual equipment as rifle, grenade-throwing gun, pistol, package of powder to be used against gas, a basket of hand-grenades, bag of sand, pickaxe, gun-grenades, signal lantern, alarm bell for gas attacks, small reel of barbed wire, rocket scoop, corrugated iron hatch-grate, shovel, wire-scissors, course broom, periscope, gun-carrier with periscope, and a gabion.

The Hydro-Electric Power Commission of Ontario at such centres as Niagara Falls, Welland, Toronto, Hamilton, Dundas, London, St. Catharines, Brantford, Kitchener, St. Thomas, Stratford, Guelph, Galt, Sarnia, Woodstock, Paris, Preston, Walkerville, Wallaceburg, Seaforth, etc., is supplying power for manufacturing munitions of war, such as abrasives, aeroplanes, aluminum, beds, blankets, boots, brass sockets, brushes, camp ranges, carbide, castings, chemicals, clothing, cloth wire, cutlery, flour, fuses, harness, kit packs, primers, provisions, rifles, shells, shell parts, shell boxes, shell-making machinery, special lanterns, special steel plugs, special tools, wagons, etc.

The uses to which electrical energy in large quantities is applied in the electro-chemical industries are well described by a statement recently made by Mr. F. J. Tone, of the Carborundum Company, Niagara Falls, N.Y. He says:

> "The part set for Niagara industries in the war program is a large one. They must supply the bulk of the ferro-alloys, the all-essential of the steel industry. Ferrochrome is wanted for armor plate and projectiles. The army must have chlorine for gas shells, camp sanitation, water purification, and for the Dakin solution. Explosive makers want caustic soda, potassium chlorate, and chloro-benzol. Dirigibles require silicon for generating hydrogen. Destroyers want phosphorus for smoke screens. Abrasives, cyanides, aluminum, electrodes, and many other products are urgently needed in the war game. The Aircraft Production Board had decided on the design of the standardized United States aeroplane motor. It will require quantities of ferrochrome for chrome steel crank shafts, chrome steel connecting rods, and all parts subjected to the enormous strains of a mechanism weighing less than two pounds per horse-power. Quantities of aluminum will go into crankcases and pistons. The modern grinding wheel alone makes possible the finishing to limits of a fraction of a thousandth of an inch all parts of the aeroplane engine, and thus the artificial abrasives of Niagara become the key to interchangeability."

Munition Requirements

The munition plants being served with power by the municipalities and the commission from the Niagara system, in August, were taking a total of over 78,000 h.p. with firm contracts amounting to 94,600 h.p. Some of this power cannot be supplied without cutting off other customers. Additional present demands from the Union Carbide Company, the Electro Metals Company, and other munition manufacturers, total over 45,000 h.p. The Ontario Power Company, in August, for munitions and war materials, was supplying some 44,600 h.p. This makes a total demand upon the Hydro-Electric Power Commission and the Ontario Power Company for munitions of over 186,000 h.p. Of this, however, 30,000 to 35,000 h.p. may be considered as off-peak power, thus leaving a net power capacity required of some 150,000 to 155,000 h.p. The shortage on the Niagara system for munitions for the commission and the municipalities, considered by themselves, may be placed at about 65,000 h.p.

What are some of the means by which this shortage may be supplied?

1. Increased utilization of steam power. This, at the

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[*] See report "Long Sault Rapids, St. Lawrence River: An Enquiry Into the Constitutional and Other Aspects of the Project to Develop Power Therefrom," by Arthur V. White, Commission of Conservation, Ottawa, 1913.

present time, is out of the question as a means of dealing with the problem as a whole.

2. Supplying, temporarily, water from the unappropriated surplus, to permit the utilization of the excess capacity of the plants at Niagara. This, I understand, has been provided for.

3. Curtailment of the power now used for street and other lighting; also for certain power purposes, in order to liberate more power for manufacture of munitions.

4. Utilizing the water of existing plants under more efficient conditions, such as will exist in connection with the new Chippewa project, under a head of 300 to 305 feet. It will, however, be approximately three years before relief can be obtained by such means.

5. Limitation of the quantity of power at present being exported from Canada to the United States. Owing, however, to manufacturers of war munitions in the United States being, it is claimed, also short of power, the limitation of export will require very careful consideration in its international aspects.

Details Respecting Exportation of Electricity

Consideration of the curtailment of the export of electrical power from Niagara requires a critical examination of the underlying factors. Much has been said respecting the lessening of the quantity of electric power being exported from Canada to the United Stats, and a good deal of misunderstanding has arisen in this connection. The chairman of the Ontario Hydro-Electric Commission has been urging the retention in Canada of a sufficient amount of Niagara power to assist in meeting the present exigencies. If the amount retained be such as will equalize the quantities actually utilized in each country, then instead of returning the total exported quantity of about 125,000 h.p. there would, under present circumstances of development, be only some 60,000 h.p. returnable. The figures presented below indicate, by way of illustration, a basis upon which an analysis of equity in advantages and disadvantages of present conditions at Niagara, per se, may be weighed:

Provisional Balancing of Power Generated at Niagara Falls on Both Sides of International Boundary

	Horsepower
Total power generated at Niagara Falls on both sides of boundary	653,500
One-half of total amount of power generated is	326,750
Amount of power generated on United States side	265,000
Amount of Niagara power used in the United States	390,000

Thus, according to the figures above presented, the United States would be utilizing some 60,000 h.p. in excess of half of the total amount generated, and the retention of this in Canada would make the quantities used in both countries equal.

Canada is exporting electric energy from the Province of New Brunswick to the State of Maine; from the Province of Quebec to the State of New York; from the Province of Ontario to the State of New York and the State of Minnesota, and from the Province of British Columbia to the State of Washington.

As pointed out a year ago, no country need be expected to send out of its borders that which is essential to its own existence. Having in mind the present coal situation, it is unnecessary to emphasize the vital importance to Canada of this national and international fuel and power question. Canadians should appreciate the fact that the United States has been dealing with them generously in the present distressing coal situation. Portions of the United States are as badly off for coal as portions of Canada. Between the United States and Canada there is exchange of many natural and manufactured products, and the problems which are sure to arise, from time to time, in connection with such interchange can be satisfactorily solved and the whole situation reduced to a good working basis. Canada, however, must by all means conserve against the day of her own need such resources as are available for barter. These problems call for the best statesmanship which Canada can bring to bear upon them. Only by a knowledge of all facts relating to the subject can a wise administrative policy respecting our fuel and power problems be formulated and carried out.

Discussion

Sir John Kennedy, in discussing the above paper, referred particularly to the difficulties of development on the St. Lawrence, the ice troubles, due to the fact that the river flows from the warmer to the colder areas, and consequently causes an early break-up of the ice and resultant high water. Sir John suggested the establishment of an international commission of engineers to develop a scheme for the utilization of St. Lawrence powers on the international section, on completion of which it could be handed over to a body similar to the International Joint Commission for administration. On the power being developed, if Canada did not require all her share of the power, it could be exported, but only upon such conditions as would be satisfactory to Canada, and upon short-term leases only.

Mr. R. A. Ross, C.E., of Montreal, in further reference to the paper by Mr. White, corroborated to a large extent the remarks of Sir John Kennedy. Referring to the utilization by electro-chemical works, he advocated the idea of a general survey of the water-power resources, and the allocation of certain powers for electro-chemical industries which would not likely be required for domestic or manufacturing power, the essential of a successful electro-chemical plant being a large amount of power at a low cost.

Limiting Electric Sign Displays

Fuel administrator Garfield, of the United States, has issued an order limiting electric display advertising to the hours between 7.45 p.m. and 11 p.m. It is difficult to estimate the amount of saving in coal that will be effected by this measure, but in New York it has been calculated that the amount of electricity used to illuminate signs is equivalent to only six-tenths of one per cent. of the company's production, and as the present order curtails only about one-half of the sale of electricity for this purpose, the reduction amounts to not more than three-tenths of one per-cent. of the total business of the company.

New Zealand Town Wants Electric Plant Data

The town clerk of Dannevirke, New Zealand, has made application on behalf of the members of the borough council for full particulars, with estimates, of the most suitable schemes for providing an electric lighting plant capable of supplying a place of about 6,000 inhabitants. This offers an opening for American electrical machinery and supplies—lines that in the past have been coming largely from Europe. Communications should be addressed to "The Town Clerk, Dannevirke, New Zealand."—U. S. Commerce Reports.

It is obligatory for us to join in concentrated commercial action not only to defeat Germany in the "No Man's Land" of the war, but in order to meet Germany after the war on equal terms on Every-Man's Ground of international industrial competition. For the enemy, even while in the throes of the terrible war he has forced upon all humanity, is preparing as carefully for a future worldwide trade campaign as he did for the military onslaught he launched on an unsuspecting world in August, 1914.—F. H. Sisson, Vice-President Guaranty Trust Co., New York.

Electric Railways

Five Cents Worth of Railway Service is Today Too Little to Satisfy the Ordinary Citizen

Why should a street car fare be fixed at 5 cents the continent over when the price of a kilowatt hour of electric energy ranges all the way from 1 cent up to 20 cents?

Where is the difference between an electric railway company and an electric light company that makes it possible to fix an arbitrary rate in the one case and leave the field wide open in the other?

The reason a kilowatt hour costs more in one city or town than in another is, in a general way, because it costs more to produce and deliver it. This fact is universally recognized. Does, then, the fact that the street railway fare in every city and town on this continent is fixed at five cents mean that the cost of a ride is the same in all sections of the country? Do not practically the same variable elements determine the cost of operation in both the railway and the lighting plants? Does it not follow that the cost of giving a ride also varies greatly?

The whole matter, plainly, boils down to this: In dealing with the central station, customers trade in kw.h. as the units and pay a price depending on the cost of production; in dealing with the street railway they buy the five cents worth and take just so much as that amount of money will purchase.

There is probably no other commodity on the face of the earth that is sold on the same basis as the street railway fare, which is pretty fair proof that the plan is commercially unsound. Without question, the cost of carrying passengers varies tremendously with local conditions and also from year to year. If the price is fixed the service must be, of necessity, of inferior quality. If, on the other hand, people want service of a given standard quality—such, for example, as could be given for five cents a few years ago—they must naturally expect to pay more than five cents for it.

The street railway systems in every corner of this continent have been struggling along under these anomalous conditions, trying in vain to make both ends meet, and have now reached a point where the public attitude must be revised. Already in a number of United States cities the fare has been increased. Fare changes are at present under consideration in Vancouver. Other Canadian street railway systems are annually piling up deficits and few are making dividends. As an example of what may happen under the most favored conditions we may cite Twin City. This road has long been recognized as one of the best maintained and most conservatively managed on the continent and yet operating expenses for the first 10 months of this year are $491,258 greater than a year ago. If this kind of thing continues how many of our electric railways will be in existence in five years?

We do not believe there is any other solution of this condition than that our railway fares be sold on the same basis as all other commodities—that the cost to the patron shall be based on the cost, to the company, of production. Any other basis is economically unsound and will only continue to aggravate and accentuate the present state of dissatisfied patrons and financially embarrassed companies.

Some Interesting Details of Special Features of a Standard "Safety" Car

The successful development of the light-weight safety street railway car is introducing radical changes in the operation of street railways, resulting in large economies of operation and improved service to the public. Among the most important features in this development are the No. 258 ball-bearing motor and the light-weight K-63 controller, manufactured by the Canadian General Electric Company. Two years ago the lightest modern electrical equipment on the market weighed approximately 4,500 pounds per car. The light-weight safety car of to-day has an electrical equipment, consisting of two motors and control, weighing only 2,400 pounds. A ton of dead weight has been removed, and yet with this equipment faster schedules are being maintained than was considered possible heretofore. The immediate advantages of this reduction in weight are obvious with regard to such matters, as lower energy consumption and decreased track maintenance. For instance, to haul 2,000 pounds excess weight 40,000 miles per annum costs: For power, $50 to $70; for track and equipment maintenance, $15 to $25. But the eventual economies resulting from the use of light-weight cars and equipment will be found in the use of lighter rails for replacement work, less copper in the feeder system, smaller power station or sub-station capacity, etc., a big reduction in overhead costs and investment.

The No. 258 motor has a one-hour rating of 25 h.p., and weighs complete with gear, pinion, gear-case, and axle bearings 885 pounds. This motor has the greatest capacity for its weight of any railway motor ever manufactured. To secure its high capacity it was necessary to use a high armature speed which draws a strong current of air through the interior of the armature and across the fields. To eliminate excessive bearing wear, with consequent shortening of gearing life, ball bearings are used on the armature. These bearings keep the gear and pinion in perfect alignment and mesh, prevent the armature from dropping on the poles, and cut down lubrication trouble and expense. The high capacity of these motors in proportion to their weight permits, without injury to the motors, the highest practicable rate of acceleration—a most important feature on frequent stop lines and in congested streets, resulting in faster schedule speed. This attracts traffic, for passengers like the feeling of hustle and rapid movement which they obtain in these cars. Their low weight eliminates much of the repair work on the track, and the small current taken reduces wear on the trolley wire and requires less feeder copper.

The K-63 controller is another marked advance in the production of light-weight, compact equipment. Two of these controllers weigh 270 pounds. Compare this with the average of over 400 pounds for the lightest controllers heretofore. It is smaller in dimensions and has a wooden cover. It will handle equipments up to two 40 h.p. motors on 600 volts, thus giving a large factor of safety when operating two 25 h.p. motors on a light-weight car. The controller, with its light-weight cylinder and smaller fingers, is more easily manipulated than the controllers ordinarily used on city cars, thus relieving the operator of an appreciable amount of fatigue. Aside from this, it is obvious that the addition of fare-handling equipment to all the other apparatus on the front platform makes compactness exceptionally desirable, thereby securing a high rate of passenger interchange without jostling or possible injury to patrons.

By interlocking the operation of the control, the brakes, the doors, and the steps of a car, two dominant advantages are obtained—first, safety; second, faster schedules. Safety, because the impossibility of operating the car except as per the interlocking scheme prevents the operator from doing anything but the safe thing. Faster schedules, because the combination of the control of brakes, doors, and steps in one and the same brake valve reduces to a minimum the number of movements the operator must make.

To-day the light-weight safety car has established itself as the car of the small city. To-morrow careful analysis of individual and overlapping routes in large cities may develop the fact that many lightly-travelled lines, or even heavy lines capable of removal from congested streets, are good prospects for this latest development in the production of maximum car miles at minimum cost.

Improvements in Operating Conditions in Vancouver—The Jitney Must Go

Some months ago an agreement was made between the British Columbia Electric Railway Company and the city council of Vancouver whereby they consented to arbitrate on certain questions regarding the operation of the electric railway system, both sides to be bound by the findings of the arbitrators. The matter was placed in the hands of Mr. Adam Shortt and his report has now been handed in.

The interest in the report centers around the jitneys. The city council of Vancouver has permitted jitneys to operate freely and, as a result, at certain seasons of the year, there has been as many as 350 working in opposition to the electric railway company's system. Owing to the fact that they operate, of course, only in those sections where business is most remunerative and so deprive the railway company of a very considerable percentage of their short-haul fares—necessarily the essential part of every railway company's income—they have been able to reduce very materially the income of the company, so that it has now become impossible to maintain an adequate service without incurring a regular deficit.

The injustice of this situation, which in reality is no greater in Vancouver than in many other cities in Canada and the United States, is recognized by the arbitrator, who states that it is impossible that the present conditions should continue. It is understood the city council will abide by the decision and that the railway company will be left free, after January 1, from any opposition to those rights which they have so long been denied.

Having in mind further the increased cost of operation in practically every direction with which the railway company has to contend, certain other concessions will also be made. In future no free transfers will be given between the city and interurban cars. The company will be allowed to operate one-man, safety cars in the outlying districts and the "skip-stop" system will be introduced so that a higher rate of speed will be attainable, particularly on interurban lines.

Now that the injustice of the jitney competition has been brought so prominently to the attention of the Canadian public, it is to be hoped that the same measure of redress will be granted companies in other cities. There is possibly no railway system in Canada that has not suffered more or less by this illegal competition and more especially in the larger cities the revenues of the railway companies have been so diminished as not only to jeopardize the income of the shareholders who may depend upon their investments in these securities, but also to make it impossible to maintain the service at a standard which will satisfy the travelling public. It is not to be expected that the removal of the jitney competition will remedy all the ills of operating electric railways, but it will at least go part of the way. The increased cost of everything entering into the operation and maintenance of an electric railway system must necessitate in the very near future an increase in the cost of travelling to the public.

Educating the Public

The Bay State Street Railway Company, of Boston, is endeavoring to educate the public to understand that a fixed five-cent fare is now inadequate for the operation and maintenance of a system of which the expenses have been very greatly increased in the last four years. As an example, they are using car posters, one of which shows, at the top, a very large but very thin dog. He is lying on his back apparently unable to rise. His master is offering him a small portion of meat labeled "5 cents worth of dog meat," which the animal is unable to eat. Underneath is the following legend:

Oh, see the dog!

What is the matter with the dog?

The dog is dying.

Why is the dog dying?

Because he is too weak to eat the 5-cents worth of meat.

You see, when the dog was a pup 5-cents worth of meat was enough.

But when the pup grew to be a big dog, the man still gave him only 5-cents worth of meat each day.

Now the dog is so weak he is going to die.

Oh, the poor dog!

The inference is, of course, as will be evident to any intelligent patron of the street railway company, that the five-cent fare, which may have been sufficient to pay expenses in by-gone years, is far from enough at the present day when the cost of everything entering into the operation and maintenance of a street railway, has very much increased.

Detroit Rates Are Up

The Detroit United Railways Company recently announced a decision to cancel its low fare agreement with the city and immediately inaugurated a straight five cent cash fare, which is being charged on all lines not being operated under the "eight tickets for a quarter" franchise. The same company has voiced its intention of placing a number of "safety" cars in operation, with a view to ascertaining their fitness in Detroit.

Electric Welding

Electrical welding apparatus is now used for cutting, joining, and building up metals in the manufacture of new machinery or other articles and in the repair and alteration of old ones. Electric welding has found a practical application in nearly all metal working industries, from the manufacture of small sheet metal boxes, small and complicated metal parts, such as those used in watches, to the building of great steel steamships and the structural work of modern skyscraper buildings and bridges. Iron, steel, copper, brass, and various other metals and alloys may be welded with varying degrees of success dependent upon the properties of the metals.

Ottawa Electric Boosted Victory Bond Campaign

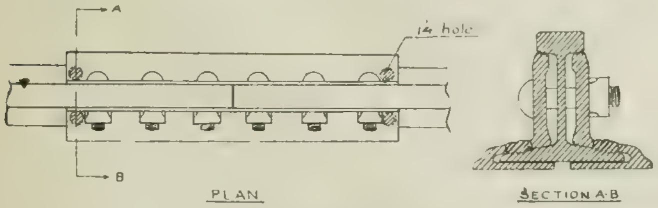
The Ottawa Electric Company were particularly active in boosting the Victory Loan campaign as is shown by the photograph reproduced herewith of a device that was used on the "Plaza." This represents a fake dynamo which was kept in motion by a small motor inside the base. The half circle and pointer at the top were intended to represent a volt meter. The pointer, which was kept vibrating all the time, indicated from day to day the total amount of the Ottawa subscriptions.

Boosting the Victory Bond voltage.

Welding Continuous Joint Plates

Owing to the high price of copper and the difficulties in the way of getting deliveries a new method was recently used on the Sao Paulo Railway lines for welding continuous joint plates to the rails. Mr. F. Ferras, chief engineer Track and Roadway Department, describes it in the Electric Railway Journal as follows:

After a year's trial in old and new track work this has proved an effective substitute for copper bonding. Of course, it is only used in paved streets where rails are not subject to expansion and contraction. Before putting the joint plates in place 1¼-inch holes are drilled at each end, as shown in the drawing. The joint plates are then put on and the base of the rail under the holes and the sides of the holes are carefully cleaned with a file or drill. Then by the use of an Indianapolis welder steel is melted into the holes, thus forming a weld between the plates and the rail. The cost of the joint made by this process is about one-fifth the cost of the copper-bonded joints without taking into consideration the time and expense of placing the joint plates temporarily for aligning and levelling the track and then taking them off again to install the copper bond inside the joint plates.



A substitute for copper bonding.

Women as Railway Employees

The Interborough Rapid Transit Company and the New York Railways, New York, recently announced that as a war measure the companies would receive applications from women for positions as station employees on the subway and elevated lines and as conductors on the surface lines. Preference will be given to dependent women relatives of employees now in the army and navy, and the pay will be the same as for men. It is not the intention of the company to replace men now employed by women, but only to fill vacancies as they occur. Applicants must be between 21 and 45 years of age. The women conductors will be placed on the pay-as-you-enter cars first.

Personals

Mr. C. C. Weldon has been appointed superintendent of the International Transit Company, Sault Ste. Marie, Ont., succeeding Mr. J. Summerhayes, resigned.

Mr. Alan Sullivan, Secretary Canadian Electrical Association, has joined the Royal Flying Corps in the capacity of equipment officer. He leaves for England shortly.

Mr. A. W. Lamont, sales engineer of the Canadian Westinghouse Company, Winnipeg, has been elected a junior member of the Canadian Society of Civil Engineers.

Mr. R. Winter, son of Mr. W. H. Winter, plant superintendent of the Bell Telephone Company and chairman of the Montreal Electrical luncheon, has joined the Royal Flying Corps. He is a Science graduate of McGill University.

Mr. Charles J. Desbaillets, manager and chief engineer of public utilities, city of Sherbrooke, P.Q., has been elected an associate member of the Canadian Society of Civil Engineers. He was formerly construction engineer with the Shawinigan Water & Power Company, and district engineer, Province of Quebec and Maritime Provinces, of the Canadian Westinghouse Company.

Mr. Ernest Brown, Professor of Applied Mechanics and Hydraulics, McGill University, Montreal, has been elected a member of the Canadian Society of Civil Engineers. Prof. Brown worked as assistant to Prof. H. S. Heleshaw, England, on researches in stream line motion as applied to hydraulics and electricity, and also conducted research at the Central Technical College, London, on the temperature rise in field coils of dynamos.

Mr. W. C. Hawkins, managing director Dominion Power & Transmission Co., who has just been elected president Southern Canada Power Co.

The Dealer and Contractor

Toronto Electrical Contractors Celebrate the First Anniversary of Their New Association—Remarkable Progress During the Year—Efficient Organization Promises Well for the Future

The "frazil" about which President McIntyre complained so bitterly at the last meeting of the Toronto Electrical Contractors' Association as blocking the turbines of his organization, had entirely disappeared on the evening of December 6 and the dynamos—some forty-five of them—hummed busily in perfect synchronism from 7.30 to 10.30 without a needle's quiver.

Some "forty-five" is correct, too, and this is a wonderful record out of fifty-one members. Of the balance one member was sick and the rest were out of town. If a man must go out of town, of course he must, but it is surely most inconsiderate of any member contractor to be sick on the evening of the regular monthly dinner. Next time, however, there will be no absentees, we understand.

The reason there won't be any absentees is the efficient organization the Executive have set in operation, combined with the graciously insinuating methods of the president in disposing of the tickets for the next meeting. It is not enough that each man should buy his own ticket, but so enthusiastic have the members become that it is now established as a mark of special honor that they be allowed to buy tickets for absentees—the greater number of tickets, the greater honor. Indeed, so eager a competition developed between two or three of the keenest enthusiasts that at the next meeting it is understood the president intends to put these extra tickets up at auction. How great a premium they will bring remains to be seen.

City Divided into Districts

But to return to the organization of which we spoke above. The Executive have divided the city into nine districts and each district has a chairman whose duty it is to see that the present members in his district attend meetings regularly and otherwise comport themselves as good electrical contractor citizens ought, and also be constantly on the lookout that new members may be brought into the fold. These chairmen are as follows, and inasmuch as to these gentlemen much has been given so also "much shall be required":

Beach, Geo. Dale; Riverdale, E. F. W. Salisbury; North Toronto, W. H. Douglas; North Yonge, Harry Rohlader; College, Martin Nealon; Parkdale, G. E. Davenport; Oakwood, E. A. Drury; Junction, E. C. Clarke; three downtown districts, H. Rooks, H. Hudson, and B. L. Clark

A number of interesting questions were introduced and discussed. Among other helpful items was the distribution of N. E. C. A. folders, designed to contain items pertaining to Association matters; also a printed list of the members of the Toronto Association, with street addresses and telephone numbers. It is the intention of the Executive to publish in the near future another issue of the "Association News" and Mr. McIntyre is open to receive further advertisements, though a goodly number were placed during the evening, following the dinner, and applications for space are still coming in. The secretary reported that the first issue had more than paid expenses.

The "Officiating Physician"

A most successful meeting was brought to a close by a short but stirring address by Mr. Frank T. Groome. Mr. Groome, as the chairman aptly put it, had been the "officiating physician" at the birth of the Toronto Electrical Contractors' Association just a year ago, when, on the top storey of the Royal Bank Building, the electrical contractors of Toronto decided that co-operation was better than civil war. Mr. Groome spoke humorously of the "high" born aspirations of the Association and congratulated the members that they had lived up to their birthright so thoroughly and made so great strides in the short space of a year.

Mr. Groome touched upon a number of points of special interest to contractors, among others that very vexed question of "overhead." He urged the necessity of proper accounting—so few contractors knew where they really were at, so few were able to say what their profit was, where they actually made it, or indeed whether they were making any profit at all. He instanced the case of the retailer who figured the same percentage overhead on all his sales. This was wrong because some items are difficult to dispose of, while others, comparatively speaking, sell on sight either on account of some attractive feature, a special advertising campaign, or some other similar consideration. To add the same percentage of overhead to all these items was not only bad bookkeeping but injustice to the customer.

Electrical Contractor Must Keep His Contract—Should Know the Rules

In the Supreme Court of Quebec Mr. Justice J. M. Tellier has just decided an interesting question of law which arose in relation to the non-execution of a contract. Armand Vinet, electrician, on October 30, 1915, contracted with Vaillancourt and Bastien to put electric wiring into a school building that was under construction at Ahuntsic. The contract price was $475, and one of the conditions of the agreement was that the electrician in his work should conform with the rules of the Canadian Fire Underwriters' Association. These rules are subject to change every two years, and after Vinet had started his work he learned that certain changes in the rules had been made, and became effective in January, 1916. He at once adapted his work to those changes, but finding the work was more costly than under the old regulations he declined to finish the job unless Vaillancourt and Bastien would increase the price they had agreed to pay him. They declined to do this, but held Vinet to his contract. He refused to continue the work, and sued the partners for $428.90, this amount representing the cost of the work he had done and loss of profits on the uncompleted work.

In giving judgment, Mr. Justice Tellier said that the

Canadian Fire Underwriters' Association was accustomed to change its rules every two years. The plaintiff was aware of this custom when he entered into the contract with defendants. He knew at the moment of the contract that the rules to which he had to conform in carrying out his work were variable; he knew that the time for making changes was very near, the then existing rules being nearly two years old. He had afterwards, with a goodwill and without objection, accepted the conditions imposed by the new rules. There was no doubt that the new rules, which went into effect in January, 1916, were applicable to the plaintiff's work executed in the following April, and he apparently discontinued his work for no reason other than that the new rules necessitated a greater expenditure than plaintiff had looked for when he made the contract.

In the circumstances, however, Justice Tellier said the court could not consider that plaintiff had fulfilled his obligations towards the defendants, who could not be held liable to pay him for work he had not done. The plaintiff therefore was in default, and notwithstanding the fact that he had been given proper notice to continue the work he had failed to do so and defendants were obliged to engage others to complete the undertaking at a cost to them of $751.96, which was more than the amount claimed by plaintiff and more than the price of the contract with plaintiff. For these reasons the court dismissed plaintiff's action with costs.

Theo. Malm & Co.

The firm of Theo. Malm & Co. have opened offices at 202 C.P.R. Building, Toronto, where they will carry on a consulting engineering business in connection with railway, light, power, mining, and industrial plants. The managing engineer of the company is Mr. Theo. Malm, whose wide experience in the engineering and construction field should be a sufficient guarantee of the efficiency of the service this company will be in a position to perform. Following his graduation from a European university, Mr. Malm came to America in 1907, and during the succeeding years was intimately associated in various engineering capacities with the General Electric Company, of Schenectady; the Commonwealth Edison Company, Chicago; H. M. Byllesby & Co., Chicago; Sargent & Lundy, consulting engineers, and the Stone & Webster Corporation, probably the best-known consulting and operating firm in the United States. In 1912 Mr. Malm came to Winnipeg, where he was closely associated with the construction and initial operation of the Winnipeg municipal hydro-electric system. From Winnipeg he moved on to Toronto, where his work with the Toronto Railway Company, the Toronto Electric Light Company, and also with the London Electric Light Company is well known. Latterly he has been in charge of the construction and operation of the high voltage system of the Toronto Suburban Railway Company on their new extension from Toronto to Guelph.

Mr. Malm now feels that his varied and valuable experience fits him for a wider field, and, in the formation of the consulting engineering organization, Theo. Malm & Co., he is giving expression to a dream of many years' standing to enter business on his own account, where his ability will have free expression. Mr. Malm is Russian-born, and anticipates being of assistance, through his new organization, in placing his native land on a proper engineering basis, not only by supplying them with efficient material, but also in overseeing its proper installation and initial operation.

R. E. T. Pringle, Limited, have opened an office at 401 New Birks Building, Montreal, where they carry a complete range of samples and a full line of materials. This office is in charge of Mr. J. M. Timberlake.

An Illuminating Engineering Department as a General Business Getter

The practice of illuminating engineering in the central station field is not a burden on the overhead. It is not an expensive service which the smaller company may feel beyond its reach. It is a selling force that continuously proves itself profitable in many ways. The following extracts are quoted direct from letters from companies who are convinced that every dollar spent in this activity is profitable:

1. "A customer who was building a new factory came to us for advice on lighting. We planned correct illumination for several departments and sold and installed the equipment, with the result that his connected load was considerably more than he had originally planned. The results, however, were so good that he expressed his appreciation of our work and assured us that the results more than justified the increase."

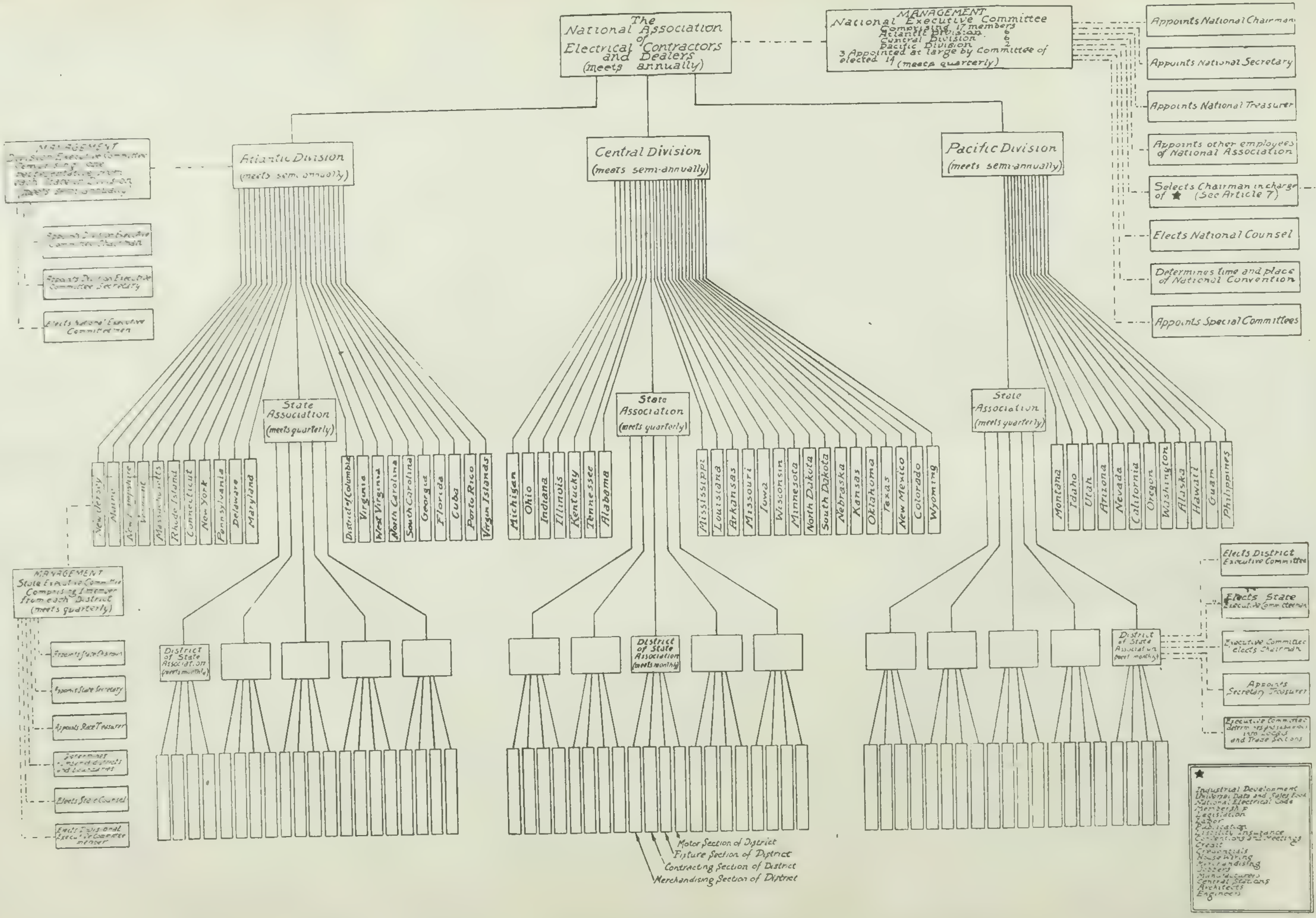
2. "A bank, which had been a customer of ours, spoke several times of the poor condition of their lighting and always feared to make a change as they thought it would necessitate increasing their bills. A thorough study was made of their conditions and their own fixtures, which were of excellent construction, were remodeled so that the lighting result finally obtained with indirect illumination was all that they could desire. When the changes were complete it was found that their current consumption was slightly less than they had formerly used with their inefficient equipment."

3. "Another customer in a store had often complained of the service which we were giving him, stating that he was sure that our service was not as good as it had been a few years previously, because he could not obtain as much light as he formerly had when his present fixtures were first installed. We found upon investigation that his lighting equipment was dirty and practically all of his lamps were burning long after their useful life. We sold him a full line of new lamps and gave him advice regarding cleaning his fixtures, with the result that he was completely satisfied."

4. "Recently we made quite a notable installation of indirect lighting in a modern reinforced concrete clothing factory, in their sewing machine room. The intensity of illumination in the room was quite high, being about 8 or 9 foot-candles. Their superintendent has stated that he is sure that there has been considerable increase in the work which they are able to do in that room over what they could have done in their old factory under the former lighting conditions. At the same time mistakes and errors have been reduced materially. They feel that part of this is due to better surroundings, but the greater part of the improvement is due to better lighting conditions."

Such definite examples could be quoted without number, but at the same time the indirect results of illuminating engineering work are quite as far reaching and important. One company mentions having improved the lighting of a church, and so impressed the members of the congregation that two factory installations resulted. Another cites a case where after the lighting of a large factory was redesigned, a number of the employees became dissatisfied with the light at home, and called upon the central station to improve it. It is this feature of illuminating engineering work that has developed the careful selection of lamps and reflectors, and has discovered the benefits to be obtained from well designed lighting. It has steadily raised the prevailing standard of illumination. It is assisting in a hundred ways the profitable progress of development. It is a stimulative commercial force that helps the central station build up its market. And whether the salesman calls himself "illuminating engineer" or "lighting specialist," whether there be one man or many working in the city, the effort still will be productive.

From a paper by Hogue, Law and Whitehouse, before I.E.S.

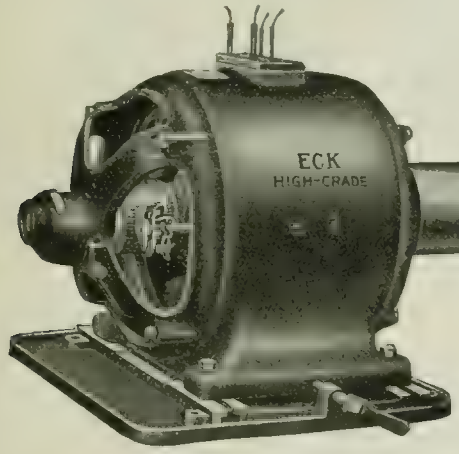

The National Association of Electrical Contractors and Dealers (meets annually)
MANAGEMENT National Executive Committee Comprising 17 members Atlantic Division 6 Central Division 6 Pacific Division 2 3 Appointed at large by Committee of elected 14 (meets quarterly)
Appoints National Chairman
Appoints National Secretary
Appoints National Treasurer
Appoints other employees of National Association
Selects Chairman in charge of ★ (See Article 7)
Elects National Counsel
Determines time and place of National Convention
Appoints Special Committees
Atlantic Division (meets semi-annually)
Central Division (meets semi-annually)
Pacific Division (meets semi-annually)
MANAGEMENT
Appoints Division Executive Committee Secretary
Elects National Executive Committeemen
New Jersey
Maine
New Hampshire
Vermont
Massachusetts
Rhode Island
Connecticut
New York
Pennsylvania
Delaware
Maryland
State Association (meets quarterly)
District of Columbia
Virginia
West Virginia
North Carolina
South Carolina
Georgia
Florida
Cuba
Porto Rico
Virgin Islands
Michigan
Ohio
Indiana
Illinois
Kentucky
Tennessee
Alabama
State Association (meets quarterly)
Mississippi
Louisiana
Arkansas
Missouri
Iowa
Wisconsin
Minnesota
North Dakota
South Dakota
Nebraska
Kansas
Oklahoma
Texas
New Mexico
Colorado
Wyoming
State Association (meets quarterly)
Montana
Idaho
Utah
Arizona
Nevada
California
Oregon
Washington
Alaska
Hawaii
Guam
Philippines
MANAGEMENT State Executive Committee Comprising 1 member from each District (meets quarterly)
Appoints State Chairman
Appoints State Secretary
Appoints State Treasurer
Elects State Counsel
District of State Association (meets monthly)
District of State Association (meets monthly)
District of State Association (meets monthly)
Motor Section of District
Fixture Section of District
Contracting Section of District
Merchandising Section of District
Elects District Executive Committee
Elects State Executive Committeeman
Executive Committee elects Chairman
Appoints Secretary Treasurer
and Trade Sections
★
Industrial Development
Universal Data and Sales Book
National Electrical Code
Membership
Legislation
Labor
Publication
Liability Insurance
Conventions and Meetings
Credit
Credentials
House Wiring
Merchandising
Jobbers
Manufacturers
Central Stations
Architects
Engineers

This diagram illustrates graphically the proposed re-organization of the National Electrical Contractors' Association into the National Association of Electrical Contractors and Dealers. Canadian conditions as yet have not appeared to justify the formation of a Dominion-wide Association, but the scheme herewith may easily be adapted to our special needs. A Dominion organization could meet annually and provincial sections semi-annually. The provinces could be divided into districts meeting quarterly and these again into local sections meeting monthly. Already much of this material is available. It remains only to co-ordinate the various elements.

What is New in Electrical Equipment

High-Grade Commutating Pole Generators and Motors

A line of commutating pole, direct current generators and motors, which are known under the trade name of Type B "High-Grade" is now being made by the Eck Dynamo & Motor Company, Belleville, N.J. The motors are made in sizes ranging from one-half h.p. to five h.p., at 1750 r.p.m. in constant speed and adjustable speed, open and semi-enclosed designs. The frame construction for the open type machine is shown in the accompanying illustration. The semi-enclosed machines are fitted with cast grated removable covers over the openings in the commutator and brackets. Enclosed machines are fitted with solid cast removable covers over the openings of the commutator and brackets. The armature of these machines is made of laminated sheet steel and the commutator of hard drawn copper bars thoroughly insulated by mica segments and sleeves. The brushholders are of the box type with radial feed. Carbons with low friction co-efficient are used and operate on a low current density. The bearings are of the ring oil type made of special bronze bearing metal. The motors are wound for standard voltages of 115, 230 and 550 volts and will operate satisfactorily, it is said, but with some variation in speeds and temperature rises of shunt fields when running on small variations of these voltages. The generators are made as open type machines in sizes from .07 kw. to 4 kw. for 125 and 250 volts. The Northern Electric Company, Limited, are exclusive distributors in Canada on this line.



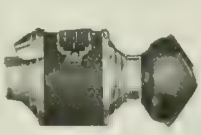
Sales Plans for an Electrical Christmas

A special holiday number of the "Monthly Sales Service" has been issued by the Society for Electrical Development, featuring sales plans and advertising for an electrical Christmas. The book is full of excellent suggestions regarding window displays, store demonstrations, Christmas letters, Christmas advertising, and so on. The newspaper advertising suggestions are especially practicable, and cuts for their reproduction may be obtained at reasonable cost from the society's headquarters, 29 West Thirty-ninth Street, New York.

Much of this Christmas campaign advertising material is furnished to both members and non-members of the society free of charge. The material available consists of window lithographs, wreath door hangers, window and store cards, price cards, poster stamps, "suggestions" folder, "gifts electric," lantern slides, motion pictures, form letter, matrix, official poster; cuts, official poster; matrix, newspaper ads; cuts, newspaper ads (cuts furnished of illustrations only, or with reading matter included); news items.

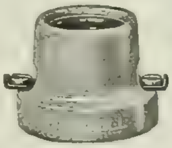
The Mute-a-phone

The illustrations herewith show a secret telephone transmitter, manufactured by the Pelouze Manufacturing Company, Chicago, and called the "mute-a-prone." By the use of this invention you not only do not annoy others by your conversation, but you are enabled to speak in such a low tone that others are unable to hear you. It thus contributes very materially to the privacy of one's business. The mute-a-phone is not permanently attached to the telephone, but may be instantly applied to any telephone mouthpiece.

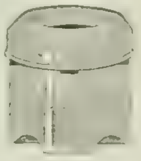

Mute-a-phone

Porcelain Receptacles

The illustrations represent a new line of porcelain receptacles which Harvey Harvey Hubbell, Inc., are just placing on the market. No. 9171 is a cleat receptacle, which is supported by one screw through the centre of the device. No. 59275 is another type of cleat receptacle, made with lugs on each side, to accommodate wiring raised 1 in. from the surface. No. 61988 is a receptacle for conduit box and metal sign work. This receptacle is constructed with five notches in the base. Bending one projection from the metal plate into any one of the notches will guarantee a permanent location for the receptacle after its installation. Another feature of this device is the screw ring, which will permit the removal of the shell without disturbing the wiring. All of these are rated 660 watts, 250 volts.


No. 9171

No. 59275


No. 61988

The Crouse-Hinds "Boy"

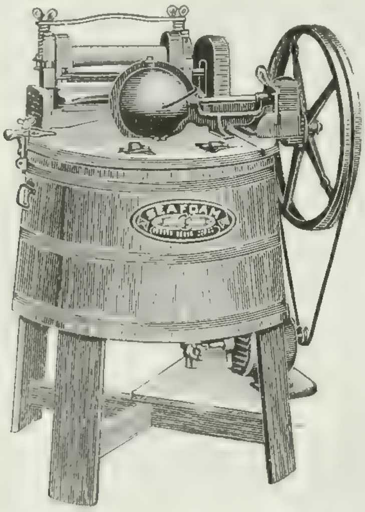
The Crouse-Hinds Company of Canada have issued an attractive calendar for 1918, one sheet for each month. Each sheet is also attractively illustrated by an item of Crouse-Hinds equipment, prominent among which is the picture of the boy contractor now recognized throughout the continent as one of the most valuable and unique figures in trade advertising. A little slip attached to the catalogue and signed by the company, reads, "Please give our boy a prominent place in your office."

A New Shurlok

Pass & Seymour have recently placed on the market their Shurlok porcelain socket. The advantage of this socket is that it provides a practical means of locking the lamp in the socket so that it cannot be removed without the use of the master key. The Shurlok screw with the special head is carefully designed so that it cannot become lost or misplaced. The lamp base is carefully positioned in the socket shell by especially placed ribs or corrugations on the inside of the porcelain shell which prevent the lamp from being forced out of perfect alignment with the socket.

The Dowswell "Seafoam"

The accompanying illustration shows the new "Seafoam," Style A, electric power washer and wringer, manufactured by Dowswell, Lees & Company, Limited, of Hamilton. This washer is equipped with ⅛ h.p. motor. The frame is all metal. The mechanism which drives the wringer is covered in so that there is no danger to the operator. This wringer is permanently attached to the washer and runs automatically in either direction, independently or while washing is being done. The operating mechanism is very simple and durable. This machine is intended to supply an efficient piece of equipment at a moderate price.



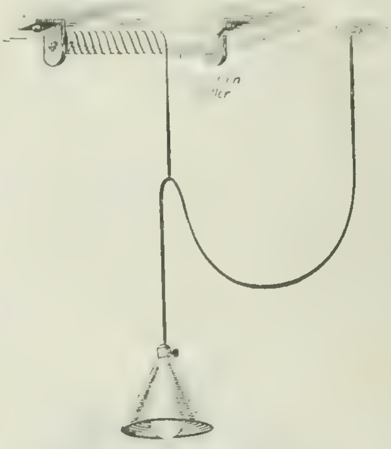
Change in Staff Personnel

Mr. Norman B. Hickox has been appointed sales and advertising manager of the National X-Ray Reflector Company. Mr. E. H. Cameron, formerly sales manager, has severed his connection with the company and is now located in Seattle. Mr. Hugh D. Butler, formerly manager Chicago sales, has been appointed assistant sales manager. Mr. Guy R. Hastings, formerly assistant manager Chicago sales, has been appointed manager Chicago sales. Mr. George D. Bryson has been appointed assistant advertising manager.

The Wagner Electric Manufacturing Company, of St. Louis, announces the opening of a sales office at 129 Church Street, New Haven, Conn. This office is in charge of Mr. C. M. French, formerly representative at Springfield, Mass.

Adjustable Lamp Hanger

A writer in Power describes the use he has made of an old window shade roller to fix up an adjustable lamp hanger over his work bench. A search in the attic of most homes would discover one or more of these rollers, and as the illustration shows, it is installed easily and at no expense whatever and should provide a very satisfactory adjustment. An advantage that will be noticed is the possibility of moving the lamp through a considerable range in a horizontal as well as a vertical plane.



Doing Its Bit in the Trenches

Mr. G. T. Bell, private in the 6th Canadian Field Ambulance, a former employee of the Fred Thomson Company, Limited, Montreal, has forwarded to Mr. Clarence Thomson, a member of the firm, a cutting of the latter's professional card advertisement from a copy of the "Electrical News" found in the trenches. Private Bell, in a covering letter, says: "Having found the enclosed cutting in an old mud-covered publication (Electrical News) that I picked up among the mud on our present theatre of operations, namely, the section of line we hold on the Western front—of course, by "we" I mean the Canadians as a whole, not any individual unit—I am taking the liberty of forwarding the same to you, as a proof of the wide circulation of the name of Thomson. Providing it were possible to have some of your equipment here one could easily show the public of this portion of the universe the value of machinery of correct design and manufacture, particularly in so far as a.c. is concerned."

Trade Publications

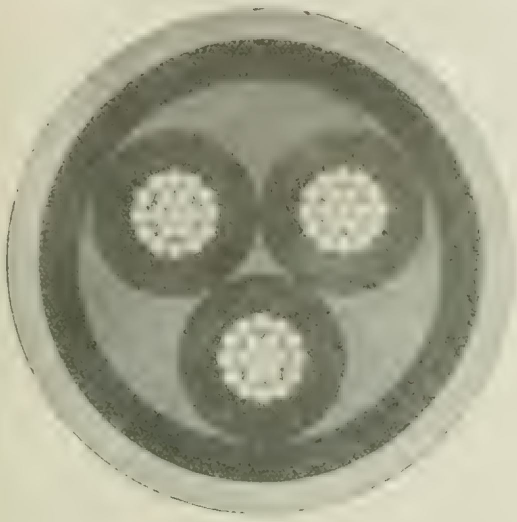
The Exide Battery—Handbook R.B., fifth edition, describing the Exide battery for automobile starting, lighting and ignition service, manufactured by the Electric Storage Battery Company of Philadelphia, and distributed in Canada by the Canadian General Electric Company.

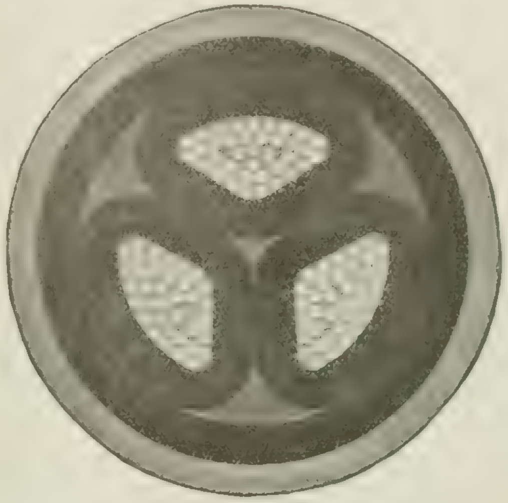
C. G. E. Publications. Catalogue No. 47901—Panel boards and cabinets—a 70-page, splendidly illustrated booklet, describing Sprague panel boards and cabinets of the various types manufactured. Bulletin No. 47471—An illustrated description of type FK 25 oil circuit-breakers.

The Duncan Electrical Company, Montreal, are distributing a folder illustrating their electrical specialties; also an export price list covering the various specialties accompanies the folder. This company have also distributed leaflets describing their new style, single pole, snap switch, and their new electric lantern attachment, "Verilite."

PHILLIPS' CABLES

as supplied to the Toronto Hydro Electric System





These illustrations show cross sections in the original size of cables recently supplied to the T. H. E. System and reordered by them for further extensions. The specifications are as follows.—Conductors composed of 37 strands each, .082 in. diameter. Thickness of dielectric on each conductor, .210 in. Thickness in belt, .210 in. Thickness of lead sheath, .160 in. Overall diameter, 2.61 in., 250,000 C.M. Three Conductor, Paper Insulated, and plain Lead Covered Cable for 13,200 volts. We can supply you with wires and cables of any size for Power, Lighting, Telephone, Telegraph, etc.

Write us for detailed information.

NOTE.—Specification of cable in left-hand cut: 3/0 B. and S. Three conductor. Each conductor 19 strands, each .094 in. diam. Thickness of dielectric on each conductor, .21 in. Thickness of dielectric on belt, .21 in. Thickness of lead sheath, .15 in. Overall diameter, 2.60.

Specification of cable in right-hand cut: As stated in copy.

Eugene F. Phillips Electrical Works, Ltd.

Head Office and Factory: MONTREAL

Branches: Toronto Winnipeg Regina Calgary Vancouver

Phillips Factory at Montreal

Current News and Notes

Chilliwack, B.C.

Mr. B. S. Harton, formerly in charge of the B. C. E. R. sub-station at Matsqui, has been transferred to Chilliwack.

Halifax, N.S.

Theodore Burgess, Inspector for the Nova Scotia Tramways and Power Company, Halifax, N.S., was killed in the recent disaster.

Hamilton, Ont.

The Canadian Westinghouse Company, Limited, subscribed $400,000 to the Victory Loan, and employees raised the total to nearly $600,000.

Moncton, N.B.

An electric light and power plant designed to serve the two New Brunswick municipalities of Rexton and Richibucto, both in the Moncton consular district, was completed recently. The generating station is operated by water power developed from a dam across the Kouchibouguac River, 12 miles upstream from Richibucto. This dam is 210 feet long and stands 28 feet high on a base of 30 feet; the spillway is 21 feet.

Montreal, Que.

The Western Canada Power Company reports October operating revenues $40,775, increase 17.2 per cent., and net earnings $30,227, increase 37.1 per cent., compared with October, 1916. Net earnings for twelve months ended October 31st last totalled $338,378, increase 34.1 per cent. over previous year.

The Royalite Electric Company, Montreal, Que., have registered.

Nelson, B.C.

A new generator is now being installed at Nelson, B.C., and will be in operation at an early date.

New Westminster, B.C.

The B. C. E. R. Company have completed an extension of their power line in South Westminster, B.C., from the Hjorth road school house to Murphy's farm—a distance of nearly one mile—opening up an important section well populated.

Renfrew, Ont.

The International Molybdenum Company, Orillia, Ont., are moving their plant to Renfrew, Ont. A considerable quantity of power will be required which will be furnished from the new development of the Calabogie Light and Power Company.

Ste. Anne de Bellevue, Que.

The Electric Shop (Mrs. J. E. Burd), Ste. Anne de Bellevue, Que., has registered.

Sydney, N.S.

The Cape Breton Electric Company, Sydney, N.S., E. L. Milliken, manager, will place a number of safety cars on their lines early in the new year. These cars will be of the Stone and Webster standard type.

Thorold, Ont.

Thorold, Ont., ratepayers will vote on the question of whether or not the town will enter into a contract with the Hydro-electric Power Commission for a supply of power, as an addition to that [illegible] by the town plant.

Toronto, Ont.

Gross receipts of the Toronto Street Railway Company this year are $267,125 in excess of the same period last year. The gross receipts for November alone were $537,505, as compared with $489,987 in November last year.

The board of control, Toronto, have decided to submit the question of purchasing the Toronto Street Railway, at the expiration of the franchise, to a vote of the people at the coming municipal election.

Wiarton, Ont.

The Hydro-electric Power Commission of Ontario are estimating on the cost of an electric light and power plant in Wiarton, Ont.

Trade Publications

Holophane Reflectors—Catalogue No. 800 by the Canadian General Electric Co., illustrating and describing, in a condensed form, Holophane prismatic reflectors and globes for all kinds of illumination.

Curve Drawing Instruments—Bulletin 46021, by the Canadian General Electric Company, illustrating and describing Types CR and CR-2 curve-drawing ammeters and voltmeters. This bulletin supersedes No. 4706.

Delco Light—An attractive booklet issued by the Domestic Engineering Company, Dayton, through their Ontario and Quebec distributors, C. H. Rooke, Limited, 173 King Street East, Toronto, describing the isolated plant manufactured by this company.

Motors and Generators—The second of a series of catalogues of industrial motors has just been distributed by the Westinghouse Electric and Manufacturing Company, of East Pittsburgh, Pa. This is known as Catalogue 30, and covers the company's complete line of direct current motors and generators for industrial service. After several pages giving general information regarding the ordering, classification and selection of direct current motors, there follows complete description, rating and dimensions for type SK commutating-pole motors, various modifications of type SK elevator motors, reversing planer motor equipment, type CD motors, headstock equipment for woodworking plants, type SK and CD motor-generators and arc welding equipment. Much new information is given especially on such subjects as arc welding, headstock equipment, motion picture service and battery charging service. The new catalogue is identical in size and will fit the binder for the company's line of catalogues covering supply apparatus and small motors.

Electrical Machinery and Repairs

Armatures Complete, Armatures Rewound, Armature Coils, Armature Shafts, Field Coils

Commutators New, Refilled or Assembled

Cleveland Armature Works

Cleveland, Ohio

TK
1
E44
v.26
~~Physical &~~
~~Applied Sci.~~
~~Serials~~

Engineering

Electrical news and
engineering

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